ELECTRICAL WORLD

JANUARY 28, 1939

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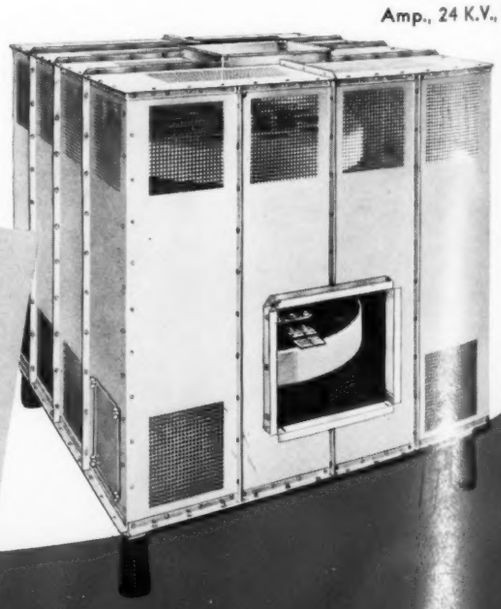

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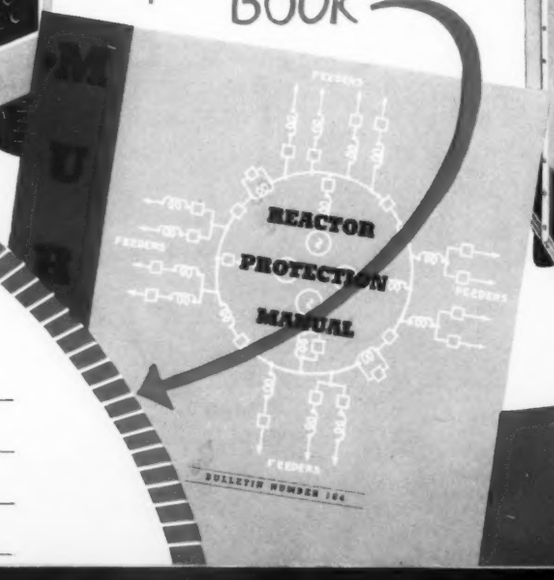

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ELECTRICAL WORLD

JANUARY 28, 1939

Unity of Action

Public opinion is definitely shifting to the side of private utility ownership and operation because the people believe that private initiative offers the best opportunity for a restoration of employment and purchasing power. The public, in other words, has seen the shift to autocratic methods and has not approved. Democracy still rules in the United States.

Such public good will can be maintained, however, only by positive action. The public is looking toward the utility industry to start a substantial program of spending, which will unlock the door to prosperity in the heavy goods industries. What is the industry going to do? What can it do? What will it spend actually? When will it start? What is holding it back?

In other words, the public is waiting for the program of the utility industry, but as yet all it has heard has been the announcements from Washington. The public doesn't understand that there is no such thing as a united utility industry.

Operating properties have their own local programs. There is no national policy or program on the part of the electric utility industry, but it is time there was such a program and it was taken directly to the public.

The utilities can be very proud of their construction record for the past nine years, a record which probably is better than that of any other industry. The public does not know it; all it has heard is that the utilities have been holding back, trying to force the government's hand.

The utilities, however, can and will spend in even greater amounts, provided they are not being constantly harassed. The public is entitled to know how much can be spent and why the larger expenditures are not being made.

There are still people in and out of Congress who are demanding TVA rates for all sections of the country. What is the public going to believe if it hears only the one side?

The public is entitled to know the facts about the several government power projects. So far almost the only information comes from Washington.

There are several things the public is entitled to know and understand. The people want free enterprise, because under it there is opportunity for more employment and better employment. The people will fight for what they want, provided they know and understand.

What difference does it make if some anti-utility senator labels the publicizing of such information propaganda, with all of its ugly implications? Surely it is no crime to tell the people one's side of a case, provided it is told truthfully. Undoubtedly Washington will attempt to break up such effort by red-herring investigations and other forms of political sabotage. But that, too, can be publicized.

If democracy is to continue to prevail in this country, there must be an understanding between the voters and business. Contrary to all of its utterances, government naturally wants more and more to regulate and control business. That extended but slightly becomes autocracy.

Unified action on the part of the utility business is called for. That means organization and leadership. The need is urgent.

Predicts Flood-Stage for

By FRANK SANFORD and ROBERT NEEL
Cincinnati Gas & Electric Company

WATERSHED rainfall and run-off data are being analyzed to forecast the chronologically cumulative effect on flow cross-section and the stage reached in inundation of distribution areas. On this is based the program for emergency measures and salvage of active distribution facilities.

An extensive program has been carried on since 1937 by the Cincinnati Gas & Electric Company and its allied company, Union Light, Heat & Power Company, in Kentucky. This has included flood-proofing at the two generating plants on the banks of the Ohio River, moving or flood-proofing of several larger substations and a rearrangement or rebuilding of several major lines and distribution feeders. There still is, however, the problem of distribution lines, transformers, meters and other equipment to serve the customers in the flood area.

An economic study indicates that while the larger stations and equipment may be raised, there still are the thousands of small units that cannot be economically, and in many cases physically, raised or removed. The 1937 flood of the Ohio River was 9 ft. higher at Cincinnati than any previous flood on record, and if the rains had continued it could have gone even higher. Many transformer installations which had been built on high platforms to be above 71-ft. flood level were completely submerged by the 80-ft. flood experienced. About 25,000 customer meters and 625 transformers were submerged in that flood.

While the major floods, such as that of 1937, and a previous flood of 70 ft. in 1913, are the ones of which we naturally think the most, there are many areas affected by lower flood stages which are much more frequent than the higher level. A probability curve shows, for example, that the river overflows its banks and reaches a stage of 57 ft. every three years, 62 ft. every six years, 66 ft. every twelve years, etc. There are about 1,000 meters in houses reached by floodwater at the 57-ft. stage. At 62 ft. 2,000 more are reached and at 66 ft. 3,500 more, etc., each added foot in the stage reaching additional meters. While we are justified in raising these meters wherever possible in the lower levels, there is a physical limit to the gain in elevation, and most of them will still be flooded, although less frequently.

Fig. 1—Precipitation data obtained for 41 run-off districts

Fig. 1—Figures in circles indicate number of days for water to reach Cincinnati. Multiplying factors have been determined to convert volume of precipitation in inches over each area to cross-section area of the river at Cincinnati, at a rate of flow 5¼ miles per hour. This rate was determined by observations and checked by trial and error in the calculations, for the outlet at Cincinnati. At this rate of flow 1 in. of rain on 1 square mile will contribute 3.475 sq.ft. in cross-section for 24 hours. The multiplying factor for each locality is its area in square miles times 3.475. The cross-sections contributed by each of the areas are added chronologically to determine the amount scheduled to pass Cincinnati over a one-day period. The next step is to convert this cross-section value to the corresponding river stage by reference to the empirical curves of "surplus" water.

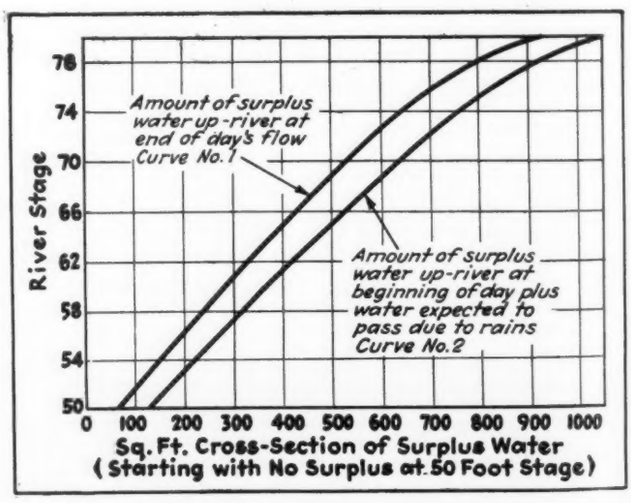
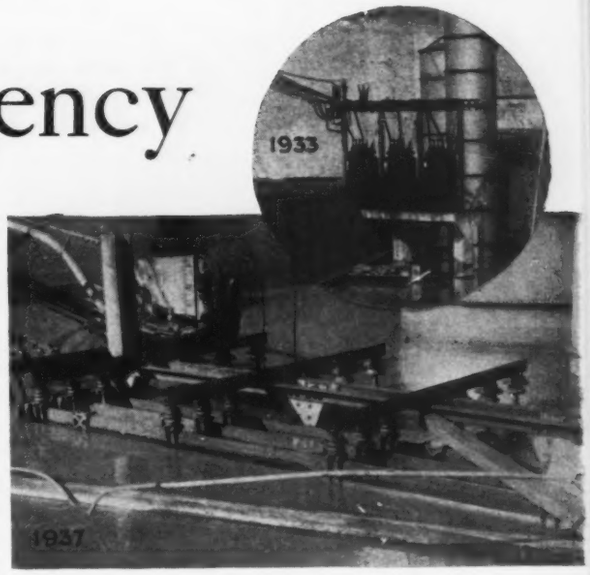

River Stage
78
74
70
66
62
58
54
50
Amount of surplus water up-river at end of day's flow Curve No. 1
Amount of surplus water up-river at beginning of day plus water expected to pass due to rains Curve No. 2
0 100 200 300 400 500 600 700 800 900 1000
Sq. Ft. Cross-Section of Surplus Water
(Starting with No Surplus at 50 Foot Stage)

Fig. 2—River stage rise in terms of surplus up-river water

Fig. 2—The next step is to determine from curve 1 the cross-section figure corresponding to the latest river stage available. This figure is added to the figure for rainfall, as obtained above. This sum is referred to curve 2 and the predicted river stage is determined. Since the rain falling in the upper basin areas will be from two to five days reaching Cincinnati, rainfall predictions for the lower basin are all that is required to extend the flood-stage prediction two or three days in advance, using a predicted stage as the latest available, in reference to curve 1.

Distribution Emergency



Our conclusion, based on a study of these physical and economical factors, is that we cannot in general raise the distribution lines and equipment to clear all possible flood conditions. Instead, we have laid out a program and schedule for emergency operation with all available forces organized for this work. Major operations during the period will include:

Emergency program adopted

1. Removal of meters from customers' premises. The flood area has been laid out in districts and tabulation of addresses prepared so that workmen can work well ahead of the water rise, strapping out the meters as removed. All meters will be stored at convenient locations in each district with special tags for easy identification for return to the same premises.

2. Distribution feeders have been rearranged where possible so that the main part of the circuit will be in the clear. All branches and taps are being equipped with cutout boxes so they can be opened as necessary to keep the main feed in service.

3. Large transformer installations have been equipped with oil head pressure tanks. When the water is too high for continued operation the line switch will be opened and the pressure tank connected to the transformer. Tests indicate that it is possible even with standard tanks to hold oil under the necessary pressure for the length of time required.

4. For the smaller installations a program of rehabilitation will still be necessary. This necessitates a good record of locations affected and a schedule laid out so that the work can follow closely the recession of floodwater.

Forecast method needed

This program must be based on a forecast sufficiently far in advance to allow organization and work ahead of the river rise and fall. During the 1937 flood it became apparent that prediction of rate of rise, probable crest and time of reaching the crest was one of the most important factors in preparation and operation. After the crest, the rate of fall and time when certain stages would be reached to permit work on the rehabilitation program was of almost equal importance.

It was soon found that our predictions were hardly more than guesses, based on extending previous flood-stage curves. There was not at that time sufficient data on which to base anything like a mathematical forecast, and not enough time to go through the extended study of past records required for such an empirical method. Since that flood we have made a study and have a method which we believe will allow us to predict fairly accurately the flood stage 24 to 48 hours in advance, both during the rise and during the fall periods of the flood.

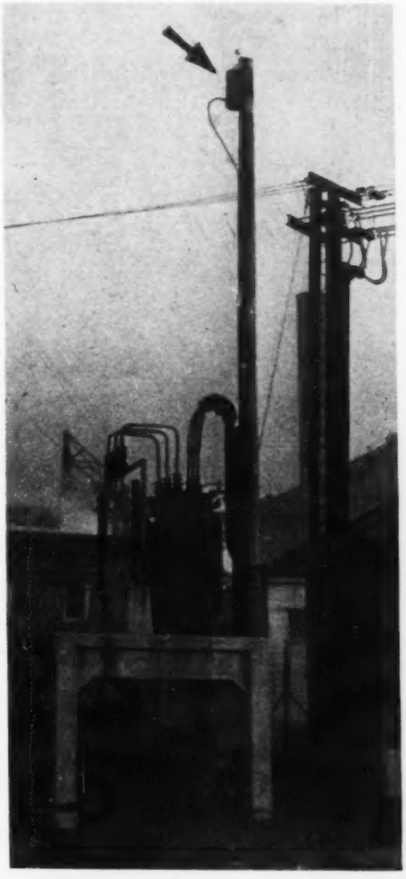


Fig. 3—Pressure oil keeps water out

Platform elevated to clear 70-ft. flood. For higher floods the oil tank (pole top at right) will be used to maintain temporary pressure in the transformer.

With the proposed method of prediction, a tabulation is made of rainfall data, multiplying factors are applied and two curves are referred to. In about one-half hour the prediction can be completed. The rainfall data are obtained from the U. S. Weather Bureau, and by applying their forecast of rainfall for the succeeding day it is possible to give further probability to the predictions.

Method of prediction

The basis of this method, and also the procedure in applying it, is in two steps:

1. Determination, principally by calculation, of the cross-section of water that must pass Cincinnati due to precipitation in the drainage area above.

2. Determination by empirical analysis of the effect of storage in the reservoir above Cincinnati.

The drainage area of the Ohio River and its tributaries above Cincinnati, comprising 90,000 square miles, is in effect a large reservoir with an outlet at one end, passing Cincinnati. Water is collected into the reservoir over its entire drainage area and the volume added each day is proportional to the precipitation in an area, times that area.

The amount removed from the reservoir each day is the volume which must pass Cincinnati and is proportional to the cross-section of the river, times its rate of flow. Pre-

[*Continued on page 75*]

Sales Goals for 1939

Engineering, Operation and Sales Co-operation Urged by National Chairman to Solve Vital Utility Problem — Specific Sales Technique Described

By HARRIS E. DEXTER

General Commercial Manager Central Hudson Gas & Electric Corporation, Poughkeepsie, N. Y.
Chairman Sales Committee, Edison Electric Institute

FROM time to time in our daily work it is a good idea to pause a while and take stock, to check up on what we are doing, try to recall why we are doing it and see where we are heading.

In our utility sales work, for example, what are we doing, why are we doing these particular things and, most important of all, just what is our basic purpose and goal? Are we merely an appendage to the utility company or are we an indispensable need? If the latter, just what are we trying to do that makes us indispensable?

Utilities' predicament

I am going to try to answer some of these questions and do so very briefly. To answer them, I believe we must first consider the industry as a whole, scan its long-term trends and see where it is heading.

To dramatize the most important facts of our business we present in the accompanying graph a simple picture of what is happening to the dollar of gross revenue we take in. The figures are based upon electric companies which make up more than 75 per cent of our utility industry.

This picture shows that over the past ten years we have spent more and more for taxes and operating expenses. Ten years ago it took 52.3 cents out of every dollar to pay wages, buy coal, run our line trucks, pay our operating expenses and provide for depreciation. The tax collector got 9.8 cents, making a total of 62.1 cents. After we paid our fixed charges, mainly interest, there was 26.9 cents left for dividends and surplus. This was in the so-called boom year of 1929.

Look at the picture today. It now takes nearly 70 cents to pay our day-by-day operating expenses and taxes. Operating expenses and depreciation take 54.1 cents, but taxes now take 15.3 cents, making a total of 69.4 cents. We have accomplished a great deal in reducing fixed charges by refunding operations, but this year, instead of about 27 cents per dollar, there is left only 18.3 cents per dollar. There is the crux of our utility problem.

Certainly our revenues are increasing year by year. Certainly we are plowing more and more money into plant. But too much of the plant is not paying its way. Too much of the business is unprofitable business. At the end of ten years of hard work we have too little to show for it. It is so little that even aside from the political situation we are having trouble in convincing the public that it can safely invest its savings in our business. In short, our business is working harder and harder for less and less. We are heading toward profitless prosperity.

Harris E. Dexter

One other point is necessary here. Not only do we have less left out of a dollar of gross, but to get the dollar in the first place requires more and more of a plant investment. Ten years ago we sought one dollar of gross out of five dollars of plant. Last year it took $6.30 of plant investment, or 25 per cent more plant, for the industry to get one dollar of revenue.

Challenge to us

Here, then, is the challenge to us. Reduced to simplest terms, the engineers and sales people must co-operate to keep plant investment down and revenues up. It is one of the big jobs management asks of us today.

The other big job is to get more net out of our gross. The engineers and operators will tackle expenses and our sales job is to add more and more of profitable or at least compensatory loads so our gross will yield some net.

Thus it is plain why the principal program of the general sales committee of the Edison Electric Institute for 1939 will be directed toward the sale of electricity in the markets which will make the best utilization of existing facilities. This is one vital goal.

As one example of a place to attack this problem in a practical concrete way, there are in our city and rural areas thousands of non-

profitable, low-use customers. They are a liability to us. Many of these customers are very poor, with no money for anything except a rather meager existence, but they all eat, and some of the food at least is cooked at home. They all use a little hot water occasionally, if not daily, and occasionally they have a small amount of food that requires preservation from one meal to the next, and they all use some light.

1,500-watt top

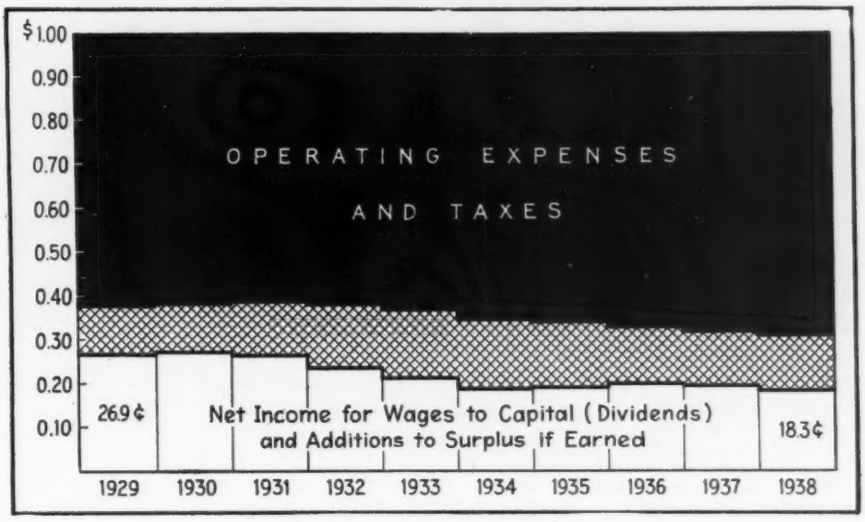
There is equipment on the market, usually 1,500 watts or less, that will perform all of these operations satisfactorily for the customer and without requiring immediate, additional capacity on the part of the utility. Generally speaking, the efficiency of this equipment is so superior to that now used by this class of customer that the rates for electric service now available will permit the customer, if he is properly instructed, to use this equipment with profit in place of the fuel he is now using.

The principal hurdle is how to get the equipment into use; how to extend the use of electricity in these poor homes so that they too may have complete electric kitchens, although not necessarily using the present conventional cooking and water heating equipment.

That it can be done, I am certain from the first-hand experiments that have been carried out. All it requires is to redirect our genius, our efforts and our thinking along the proper channels. We have had our eyes too long upon the annual increase in kilowatt-hours as a measure of the success of our sales plans. That isn't the important item, and neither is the annual increase in estimated annual gross revenue. It is the effect on the operating *net* revenue of the company that is the true measure of our sales success.

High increment rate

Here, then, is our second opportunity to solve a difficult problem which besets our industry. To continue my example, the kilowatt-hours which are added by the sale of complete electric kitchens, using devices with connected loads of 1,500 watts or less, and by the sale of good lighting bring revenues of from 3½ to 5 cents per kilowatt-hour in many cases. These kilowatt-hours help turn unprofitable customers into profitable



Profitless prosperity for utilities?
In 1929 utilities had nearly 29 cents out of every dollar of gross with which to pay dividends and attract new money. Today there is left only 18 cents per dollar. Engineers, operators and sales forces must stop this trend.

ones and at the same time render an excellent service to the customer at an operating cost that is competitive with his present methods.

In addition to the work planned for the development of the low-income residential customer, particular attention can well be given to the development of the farm market. Here our companies have expended many millions of dollars to make service available, and it is now our task to make these lines stand on their own feet, financially speaking.

How to do it?

At this stage the question may well arise: "Well that's fine, we all know it's true, but how are you going to do the job? Just what do you suggest for these low-use customers? What are they able to buy that will require little plant investment on our part and yet result in good usage at an interesting price per kilowatt-hour?"

This is a good question. Of course each company must solve its own load-building problems as presented by its own local situation, but it may be of interest and of some help to outline the way my company has answered the question.

While an abundance of hot water, with no more effort than turning the faucet, is an accepted part of daily life for families which can let electricity take over the hot water job, it is still out of the picture for those on electric lines whose ability to adopt better living methods is limited by very small incomes. Through constant home contacts with these families, in an effort to put modern conveniences within their financial reach, we found that many could use advantageously some automatic electric method of securing small quantities of hot water. They needed something different from the standard equipment, something especially designed to give kitchen service at a low purchase price and operating cost, which would fit well within their careful household budgets.

A small automatic electric water heater, answering their requirements, has been placed on the market and is meeting with success in villages, small communities and rural areas of the Central Hudson company. Manufactured by the Hynes & Cox Electric Corporation of Albany, N. Y., this new equipment is packaged complete with fittings and is suitable for over-the-counter sales in electrical shops, chain and department stores. The customer can install it himself.

Non-pressure

The non-pressure design of this water heater permits a compact, light-weight unit and cuts manufacturing costs by eliminating relief valve and welded construction. Mounted on wall-brackets above the sink, it is connected by hose to the water piping and plugged into an electrical outlet. It weighs 16 lb., holds 1½ gal., heats to 150 deg. in twelve to fifteen minutes, has a wattage of 1,400, is effectively insulated, has white enamel finish and retails for $22.50.

More than 600 of these 1½-gal.

"Modern electric kitchens"

Central Hudson calls these modern electric kitchens because they have an electric refrigerator, an electric oven (don't call the roaster a roaster, it's an oven) and over each sink an electric water heater. The coin box on top of the refrigerator is provided so the customer may purchase her appliance for a couple of nickels per day.

water heaters have been placed in use in Central Hudson territory on our regular co-operative dealer merchandising plan, with most of the sales financed for two years. This ready acceptance indicates the untouched market waiting to be supplied. From our standpoint, we find the heaters require no added plant investment, are worth 90 cents a month to us in revenue and in many cases change an unprofitable customer into one who pays his way.

Testimonials tell

What the owners think of their new hot water service—how they use it every day—shows up more clearly the sales possibilities. To secure this knowledge first-hand, our company sent a young woman, trained in home contact work, to visit more than fifty customers who had purchased these heaters at least two months previous to her call. She jotted down their comments in shorthand and turned in complete reports. Families that had struggled along with non-automatic methods for ketfleful or tankful hot water service, she found, are deriving real satisfaction from these small automatic electric water heaters. They are being used in private homes, small and large, in tourist houses, boarding houses, rented summer cottages, small lunchrooms and barber shops. They are doing duty chiefly for dishwashing, cooking, general cleaning, laundry (complete or partial), bathing, shaving, shampooing. Customers are making them do more and bigger jobs than the salesmen would suggest for fear of overselling. After using one in the kitchen, some plan to have another in the bathroom. One family carries theirs back and forth between these two rooms. The families range from one lone member to old-fashioned proportions of eight and nine. Many of them are now cooking with the new portable ovens or electric ranges and had, in the past, depended on wood or coal fires to furnish hot water spasmodically as a by-product to meal preparation. While the new electric water heaters were especially welcome in hot weather, many of them will keep right on being indispensable during the winter.

Standard heaters follow

In the first sales efforts there were naturally a few returns because the limitations of the appliance were not fully understood. Larger electric water heaters are following some of these removals. Here are a few representative customers' comments taken from the survey reports:

"It is exactly as they said it would be. I like it because we have hot water here whenever we want it. We have a furnace coil for the winter months, but this is a small house, and if you bring the fire up hot enough to heat the water, the house is so hot that it is uncomfortable. So in winter we will be able to get along without the furnace coil except for washdays, baths, etc. . . . It takes between twelve and fifteen minutes to heat the tank."

"I like it very much. Would not be able to get along without it now during this hot weather. It is such a comfort to be able to let the fire go out."

"I guess I like it especially well because I never had running hot water before in my life. It is fine to be able to go to the faucet whenever you want to and find that you have good hot water right there. If you take out all the hot water in the tank, it takes such a short time to have hot water again. The whole family is enthusiastic about it."

"We need it for washing—especially because mother is sick and needs hot water every morning and with the heater it is always there."

"We had a special faucet put in the bathroom for it and the children use it there for washing up. There is enough water for two of them and by the time they have finished it is heated up again for two more. We can move it very easily from the bathroom to the kitchen."

"It seems to take care of the needs of the boarders very well. We have two of the heaters—one in the bathroom on each of the two floors and they are used by about twenty people during the busy season, for bathing, washing out their clothes, shaving and other general bathroom uses."

"Having this and the electric oven, we have only lighted the range once during the hot weather for baths and that heated the kitchen up so much that we haven't built a fire in it since."

"I think the $22 we spent for this heater is the best $22 investment we ever made."

"It is wonderful. I have told all my friends about it. It holds enough hot water for me and I have four small children. I use it for everything except the larger washes."

Men's views

From a strictly masculine viewpoint:

"Anything that she might say about the heater isn't nearly as important as the fact that any time I want hot water to shave with it is there."

"I indorse it very heartily. It is cheaper than kerosene oil and there isn't all that watching and waiting for the kettle to boil."

(A barber) "It is almost perfect. I have never run out of hot water. It costs me a little more than it did to run the oil heater I had before, but is more than worth it because of the convenience."

Fig. 1—Generating plant No. 1; hydro units at right, steam units at left; fuel oil storage tanks at rear and coal storage yard in left foreground; Chicopee line take-off from steel structure at right

By
ARTHUR L. NELSON
Arthur L. Nelson Engineers, Boston, Mass.

Process and Power Steam Geared to Holyoke Hydro

STEAM power production in the heart of a hydro-electric situation to secure economical capacity through combined plant operation is a constant challenge to engineering and investment interest. Recent developments along this line by the Holyoke (Mass.) Water Power Company illustrate afresh the place of today's plants in meeting tomorrow's demands; for in this famous manufacturing city on the middle Connecticut River an industrial power program of unusual scope is being furthered by a thoroughly modern organization adapting present-day engineering resources to a property whose predecessors date back to the lifetime of George Washington. Intimately identified with this plant development is a new industrial steam supply system for heating and process service, the initial layout forming a logical part of a more comprehensive system which may be built as steam requirements warrant. The system has grown to a present total generating capacity of 33,500 kw., of which 22,500 kw. is in steam units.

In the fall of 1935 the company's generating plants had a total rating of 29,675 kva. There were five Edgemoor boilers in service, delivering steam at 200 lb. and 125 deg. F. superheat and installed between 1921 and 1924. Four were rated at 4,440 sq.ft. of heating surface each and the latest at 10,220 sq.ft., all being coal-fired with Taylor stokers. The steam turbo-generating units aggregated 18,000 hp. and were three in number, rated at 1,250, 6,250 and 9,375 kva. or 16,875 kva. in total. Hydro units totaled 12,800 kva. The 1935 energy delivered to the system buses totaled 70,503,800 kw.-hr., of which 2,169,900 kw.-hr. was generated by steam, 63,726,100 kw.-hr. by water power and 4,607,800 kw.-hr. purchased from interconnected utility transmission circuits. The peak load in 1935 was 11,400 kw. and the company consumed 2,307 tons of coal costing $13,812.

President Robert E. Barrett called upon Arthur L. Nelson Engineers, Boston, to study the development of the system with the assistance of the company's engineering department. It appeared that the steam plant must

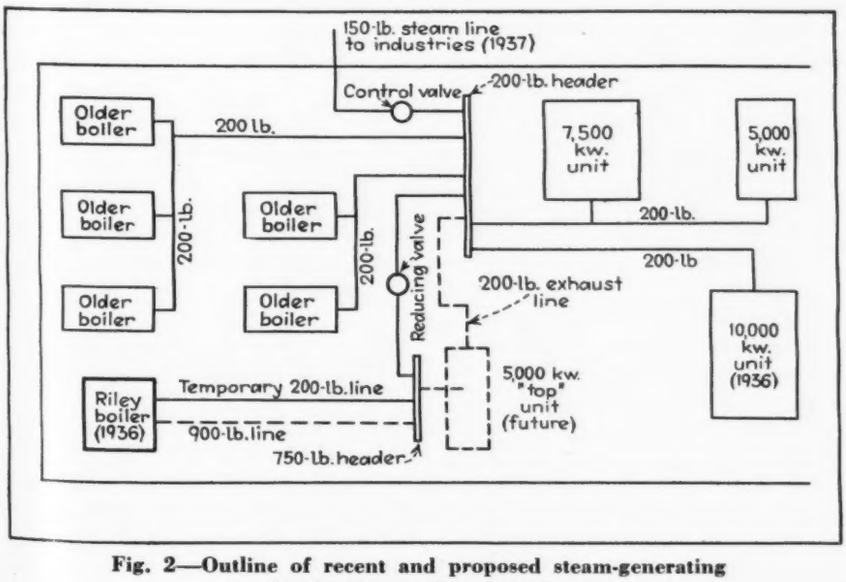


Fig. 2—Outline of recent and proposed steam-generating development at No. 1 station

Temporary use of new boiler for 200-lb. service and arrangement in case high-pressure operation ensues as planned.. Schematic only, not to scale or precise layout.

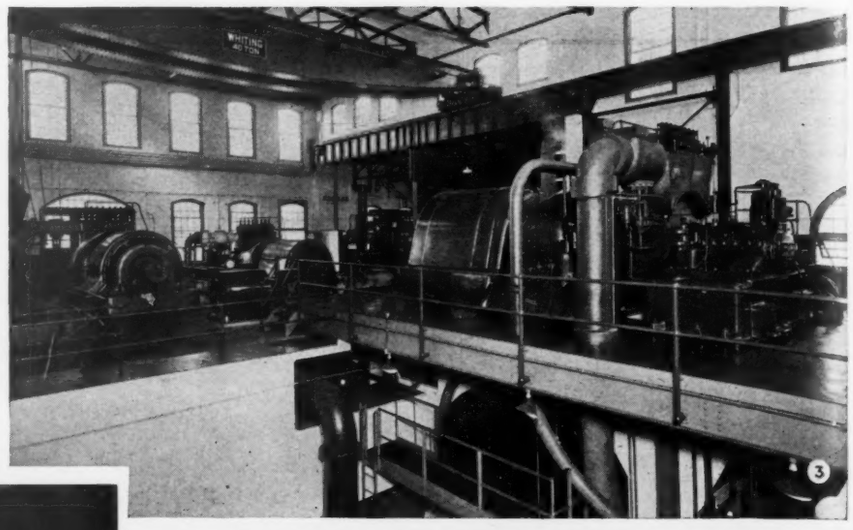
Fig. 3—Turbine room, No. 1 station

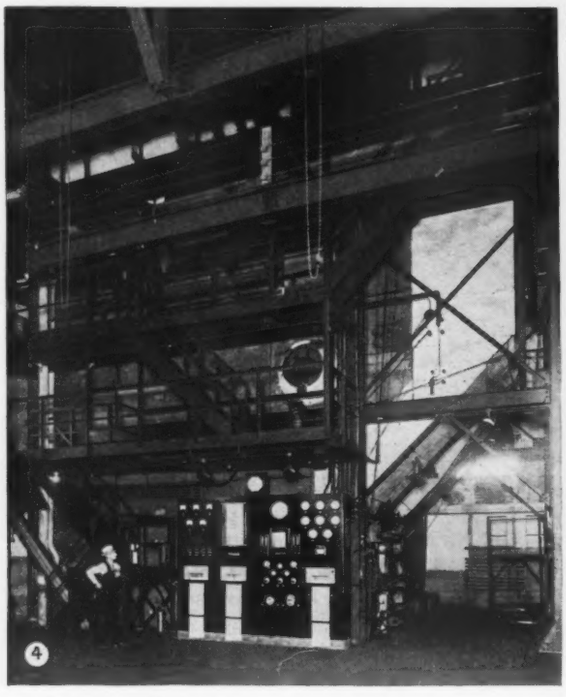
Older turbines at rear, recently added 10,000-kw., 200-lb. unit at right center and space for future unit in foreground.

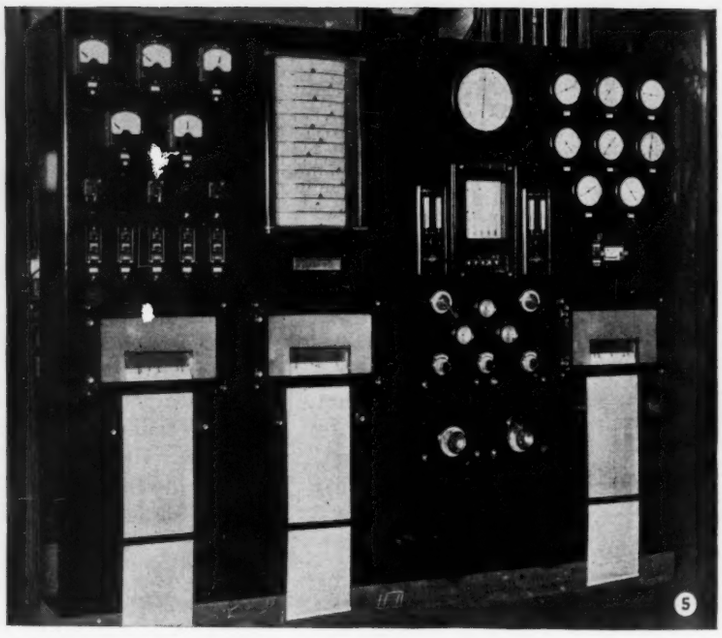
Fig. 4—Riley boiler with automatic control board and burner layout

Fig. 5—Close-up of automatic boiler control board

Master elements at the rear are actuated by the steam pressure. Air flow is automatically governed by fan and damper regulation; fan selection is automatic for predetermined load ranges, and fuel supply is automatically controlled. This equipment is designed to handle the boiler from natural draft between 5,000 and 35,000 lb. of steam per hour, with one pair of forced and induced draft fans in service from 35,000 to 70,000 or upward pounds per hour, and with both pairs and the entire air preheater in use at the higher loadings.







assume more and more importance in the operating picture as the electrical load developed, with a trend toward ultimately operating steam units on a year-round basis. Despite the strong position of the company with regard to the ownership of water-power facilities, including a masonry dam 1,020 ft. long and 30 ft. high; power canal facilities and useful modern hydro installations, the investigation indicated the wisdom of adding to the steam capacity of the system to serve increasing peak loads and act as relay during times of low water and during ice and flood conditions.

The decision was therefore made to install a 12,500-kva. General Electric condensing turbo-alternator (Fig. 3) and a Riley boiler (Fig. 4) rated at 170,000 lb. per hour at 750 lb. per sq.in. in the company's principal station (Fig. 1) near the load center of its territory, with various auxiliaries contributing to highly flexible and economical production. This was the first step in development, and the equipment went into operation in 1936. In 1937 the industrial steam supply line mentioned above was built, making another step forward, and early that year a comprehensive oil storage and handling system was installed at the generating plant.

To appreciate the flexibility of the development program it should be mentioned that a logical further step is the addition (Fig. 2) of a topping turbo-generator of approximately 5,000 kw. rating, to run upon 750-lb. steam and exhaust 170,000 lb. per hour into the 200 lb. header feeding the older turbo units. This step, if determined upon by future load requirements and operating economy studies, will enable an unusually interesting combination of new and older equipment to be worked in coordination. The investment in lower-pressure boilers and turbines will be conserved; either coal or fuel oil can be used in the latest and most efficient boiler furnace as desired, and the industrial steam supply (at 150 lb.) can be handled advantageously with respect to the operation of the combined hydro and steam systems of the power plant. A portion of the banking costs for relay boiler capacity is carried by the industrial steam service.

Automatic steam control

During the spring, fall and winter when river flows are adequate the steam line has a good load due to heating requirements. The boilers are available for both steam distribution and relay service in case of hydro

power shortage, while in summer when river flows are low and the steam process demand relatively small (with minimum or zero heating), the boiler capacity is specially advantageous for power generation.

At present the Riley boiler operates at 200 lb., delivering steam by a temporary pipe line to the existing steam turbines, as indicated in the accompanying schematic diagram (not to scale). By the use of Smoot combustion control (Fig. 5) a flexible and economical delivery of steam is provided automatically with the aid of a double pair of Sturtevant forced and induced draft fans, utilizing natural draft at low loads and insuring rapid load pick-up above established minima demands on the boiler. The new boiler occupies but little space for its capacity, being only 25 ft. square at the firing aisle and 80 ft. high from basement to the housing of the draft equipment.

It has a heating surface of 10,000 sq.ft., water wall surface of 5,600 sq.ft., an air heater of 18,500 sq.ft. and furnace volume of 8,900 cu.ft. A steel stack 35 ft. high and 8 ft. in diameter was provided in connection with the boiler. The boiler is designed to burn either oil or pulverized coal.

Natural draft operation requires the use of starting and banking guns on low load service between 5,000 and 35,000 lb. of steam per hour, with the air preheater bypassed. Between 35,000 and approximately 70,000 lb. per hour one pair of fans is in service (one induced draft and one forced draft fan, with one-half the air preheated.) Above 70,000 lb. both pairs of fans (Figs. 5 and 6) are in use, and also the entire air preheater. All fans are common to the wind box ducts and either of the fans can be used with either of the burners.

Fuel supply is automatically proportioned to load requirements, as are fan speeds and feed pump operation. The boiler feed pumps are of six-stage design and are steam-driven, with two impellers omitted from each pump pending the change to higher steam pressures. Three oil storage tanks of 800,000 gal. total capacity were provided outside the steam plant in the 1936 expansion, with two underground service tanks and auxiliary pumping equipment. Oil can be unloaded by gravity from tank cars to the service tanks or pumped into the storage tanks as desired. A coal storage area of 5,000 tons capacity is located along the river front outside the station, and a bunker of 450 tons capacity is located above the older boilers.

The company expended $498,448 in 1936 for the installation of the 10,000-kw. turbo-generator, the Riley boiler, oil storage and handling system, and auxiliaries.

Provision for topping

Studies show that the industrial steam line is self-supporting with steam direct from the boilers, but when the topping turbine is added it will receive steam at 675 lb. and 750 deg. F. It will exhaust at 200 lb. and 540 deg. F. into a 200-lb. header serving the lower pressure turbines and from which the industrial steam supply is taken off through a reducing control valve for 150-lb. distribution. In the temporary operation of the Riley boiler at 200 lb., this 200-lb. header is fed with steam by a temporary pipe line from the boiler. When the electric power load of the company reaches the stage where a topping turbine will be required the steam which the industrial line receives will already have contributed partly to its cost of generation by supplying electrical energy by the topping unit.

In 1937 the peak load was 14,400 kw., the energy generated by steam increased to 11,316,900 kw.-hr. and the output of the company's hydro-electric plants was 61,334,800 kw.-hr. The amount of purchased energy dropped about 50 per cent to 2,249,500 kw.-hr. The 10,000 kw. of steam capacity added in 1936 brought the company's total generating capacity to 33,950 kw. This gives a margin above the peak, assuming the largest unit out of service, of 9,550 kw. Without the above unit the margin above the peak with the 7,500-kw. machine out of service would have been 2,050 kw. on this 14,400-kw. peak, assuming the available river flow was sufficient to operate all the hydro-electric units at normal rating. Without the 10,000-kw. steam unit and Riley boiler the margin above the peak (which occurred on July 27) would not have been sufficient to meet the best operating requirements in this particular combination of steam and hydro.

Less than $50 per kilowatt

The added capacity, including the oil storage system, was obtained at a unit cost of about $49.84 per kilowatt, or far below the cost of developing a comparable new hydro-electric plant in the central Connecticut valley. It provides a reserve of much value in relation to low water periods and under flood conditions, with the accompanying reduction of effective head due to high tailwater. Further, it places the company in a position better to supply future load growth in Holyoke as industrial conditions improve and insures a still more reliable service to the city of Chicopee, which entered into a fifteen-year contract with the company in 1935 for the electrical requirement of the municipal lighting department. In 1937 the company sold Chicopee

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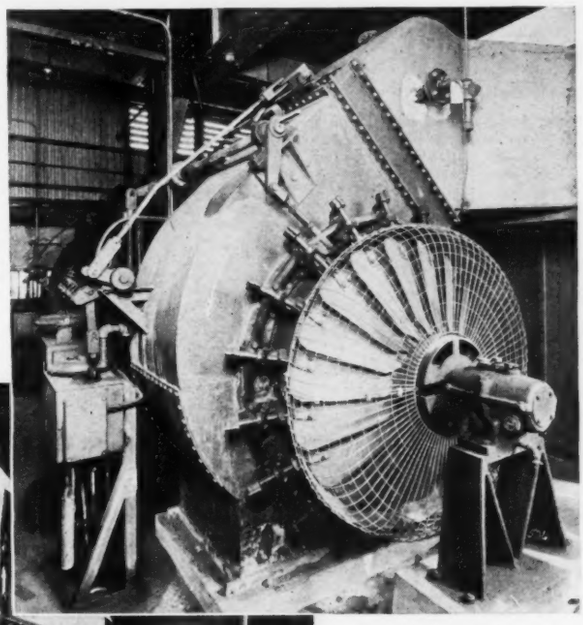


Fig. 6—Vane type forced draft fan driven by 75-hp. constant-speed motor

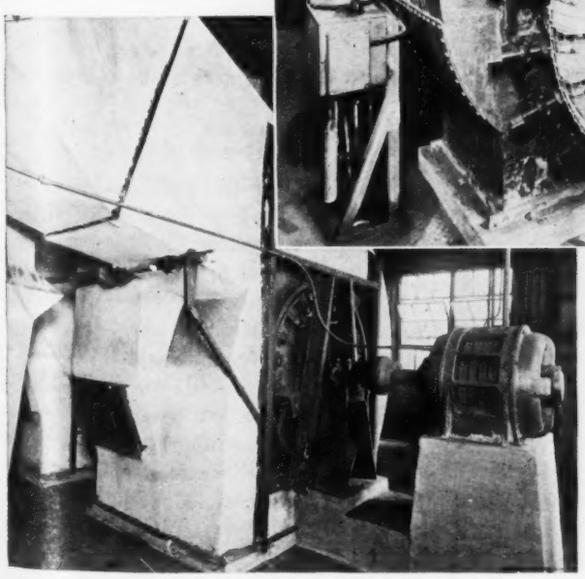
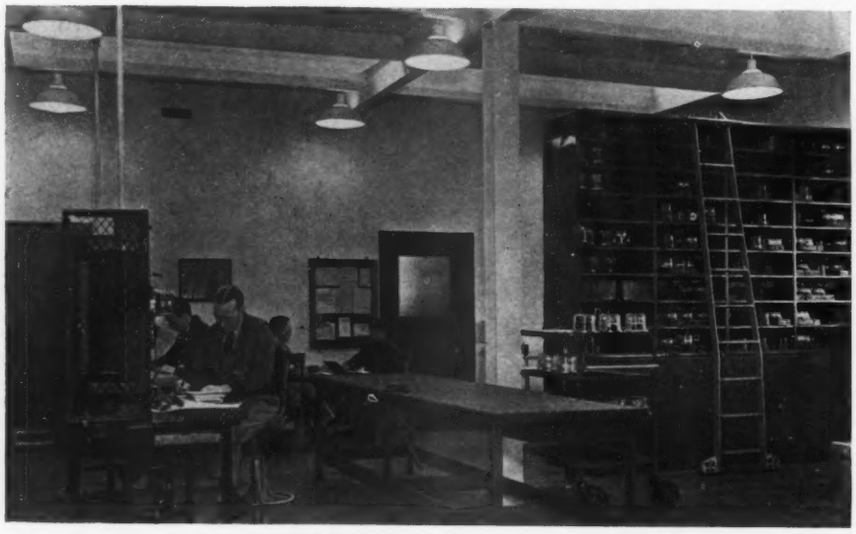


Fig. 7—Vane type induced draft fan with 150-hp. constant-speed motor drive

Precise Meter Layout for Precision Results

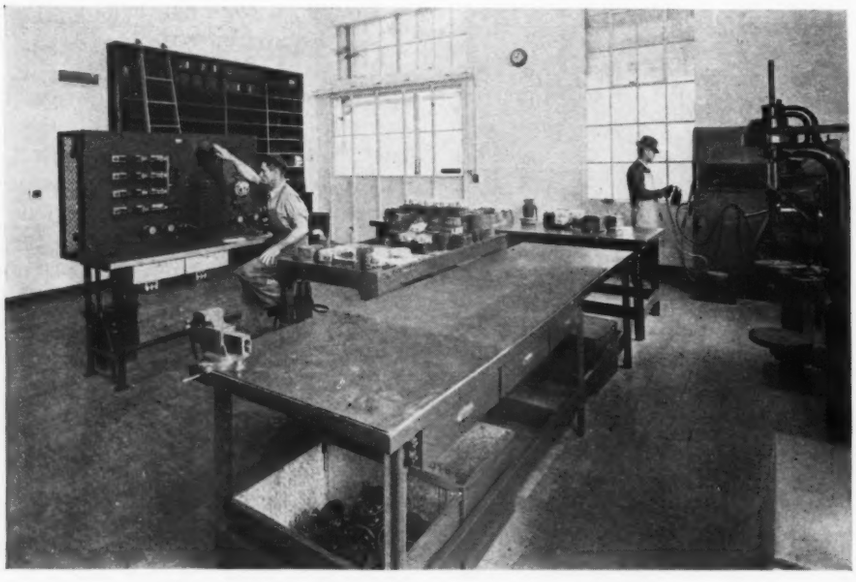
By W. H. TALBOTT

Superintendent Electric Meter Department,
San Diego Consolidated Gas & Electric Company



Test room has steel equipment, mobile ladder, hand truck, rubber-covered work bench

The work benches are of steel, and those on which meters are handled are covered with corrugated rubber matting. This protects the glass and facilitates turning the meter for removal of sealing pins, etc. For transportation within the building four-deck hand trucks are employed. These, likewise, are built of steel and carry rubber-covered shelves. Skylights provide north light and are augmented by twelve 500-watt lighting units. Modified air-conditioning equipment, circulating clean filtered air, improves efficiency of personnel throughout the entire building, but is especially beneficial to the meter testing conducted here, keeping the air temperature between 65 deg. F. and 78 deg. F. in the building.



Repair shop door opens onto loading platform—at right rear is ventilated painting chamber

METER departments too often have small beginnings in a forgotten corner that others cannot use. From this point they grow piecemeal into a hodgepodge of divisions which, from the standpoint of physical layout, are far from ideal.

Hence, the expansion which forced San Diego Gas & Electric Company's meter department into new quarters opened the way to laying out an efficient plant, with present functions coordinated and future growth provided for.

The work of San Diego's meter department embraces a variety of duties. These formed the basis of the plant's design. They include installation of services, setting and testing all electric meters, relay protection for entire system, installation of instrument, transformers, maintenance of instruments, clocks and electric meters, installation and maintenance of service conduit on poles, changing customers' wiring in cases where obsolete meters are retired, testing and correcting unbalanced voltage on consumers' premises, executing mechanical work in running services from poles to meters, emergency repairs for customers and on distribution lines.

Effectiveness the rule

In planning the new headquarters for these services there were three fundamental endeavors—to segregate classes of work, to eliminate lost motion and to provide the best working conditions possible.

The building into which the department has moved was limited by the fact that about half of it was previously a gas laboratory. The rest of it is new. Dimensions of the completed structure are 44 x 96 ft., a floor space of 4,470 sq.ft., plus 1,100 sq.ft. of basement. (See front cover).

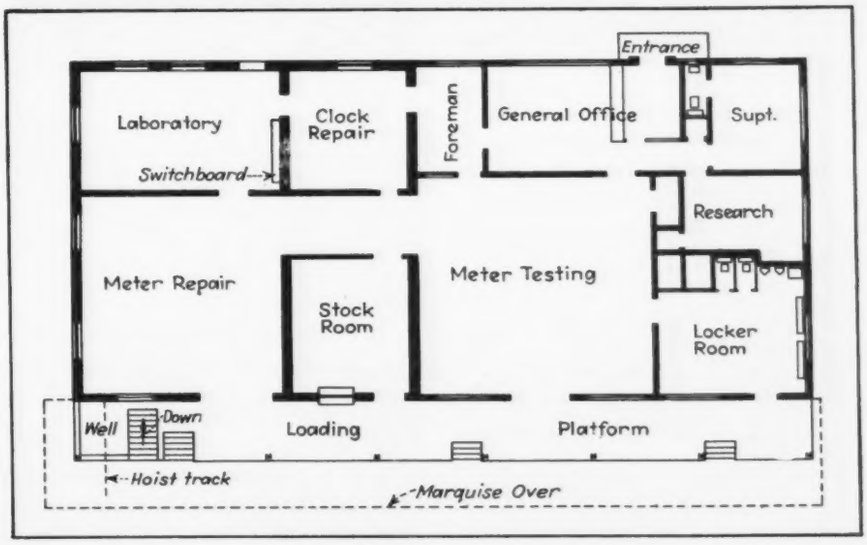
Repair shop, storeroom and test department all open directly on the loading platform, which runs the length of the building

A 14-ft. marquee extends along its entire length, surmounting the loading platform. The arrangement reduces handling time approximately 2½ man-hours per day. Connected load for lighting and air conditioning (exclusive of heating) is 16.5 kw. The basement is used for storage and for housing the transformer station, motor-generator test set and air-conditioning equipment.

W. H. Talbott, superintendent, and employee

Illumination on the superintendent's desk is 27 ft.-candles minimum to 60 ft.-candles maximum. Northwest corner for offices.

Clock and instrument room



Layout of the meter department

Much of the plant's physical equipment cannot be justified on the basis of lowest first cost. Lowest first cost was not a primary consideration. Throughout the planning of the department, decision to adopt or discard a particular kind or piece of equipment was governed by the fact that the meter department is a group of skilled personnel, performing precision work on valuable equipment. The question, then, was not how much does it cost but how much will it improve the effectiveness of the department. This, it is felt, will represent greatest economy in the long run.

Such is the case with the thermostatically controlled modified air-conditioning system, the high-intensity illumination job, the modern shower and locker room and much of the equipment directly connected with the work.

The block-wood flooring, for example, which is used throughout the working areas, is costlier than other types. But its value in reducing the fatigue of workmen was considered as well as its possible life. It con-

[*Continued on page 78*]

"Information, Please!"

Georgia Power's Information Program Builds Good Public Relations Through Good Employee Relations

By JAMES M. STAFFORD
Georgia Power Company, Atlanta

• There is no sure way to create company spirit. There are infinite numbers of certain ways to kill it.

It will be successfully created only when the men can be induced to do something for the company; to put themselves into the institution.

Company spirit can't be bought. Neither can it be paid for.

Possessed, it is an asset beyond price. —P. S. ARKWRIGHT, *President Georgia Power Company, in a speech delivered in October, 1921.*

THE statement above is indicative of the fact that for a great many years the management of the Georgia Power Company has had the conviction that the first step toward good *public* relations is the building and maintenance of good *employee* relations and understanding. They have proceeded upon the theory that "company spirit" is not something which simply can be wished for and thereby obtained.

Fundamental policies

It is one thing to have "spirit" within an organization by reason of outstanding managerial and supervisory leadership, but still another obviously important thing to make that spirit articulate by creating an intelligent employee interest in and understanding of the policies, plans, problems and operations of the organization. If the electric utility industry—along with American business generally—now realizes the necessity for better *public* understanding certainly there is no more logical approach to solution of the problem than through better *employee* understanding. These conclusions were responsible, at least to some degree, for organization of the Employee Information Program of the Georgia Power Company in September, 1937, following approxi-

mately a year's careful study of the matter.

Upon presentation of the employee program, fifteen months ago, two fundamental policies regarding its conduct were laid down:

1. That the program should be an employee, rather than a "head office," activity, and

2. That participation in the activities of the program by any of the 5,000 employees should be upon a purely voluntary basis.

At this time those responsible for operation of the program can say emphatically that it has become, more and more, an *employee* activity and that the voluntary aspect of it has made it an ever-developing, an ever-widening influence for good throughout the company.

The original prospectus for the employee program listed the following general purposes:

1. To give information regarding the company and its problems, in order to take the employee more fully into the confidence of the management and to build up pride in the employee for his position in the operation of the business.

2. To create better relations between employees and departments within the company—not alone for the welfare of the company but also for the greater personal advancement and satisfaction of the individual employee.

3. To invite employees to assist in formulating company policies.

4. To provide a routine by which employees may offer criticisms and suggestions regarding company operations and customer relations.

5. To offer training to employees in informal public speaking.

6. To supply facts regarding American business and economics; to encourage study of Georgia history and resources.

7. To promote greater interest of employees in public affairs—social, business and political.

Although a great many suggestions are originated by and exchanged through the Atlanta headquarters, the employee program functions within each of the company's six geographical divisions in the state. The chart shows the organization for the activity in each division.

Organization

The *division sponsor* is an employee who gives only part of his time to the activity, but who reports to the division manager on all matters affecting promotion of the program. Two of the sponsors are division claim agents, one is a steam heat salesman, one is an assistant division auditor, one is a division lighting engineer and another is a division transmission engineer. These men were chosen for the employee work because of their demonstrated abilities in leadership.

The *division committee* meets regularly and serves as the "general policy committee" on matters affecting all employee activities within the division.

The key people in the entire employee program are those who serve

as *group leaders*. Of course, the number of group leaders in each division varies with the number of employees in each division, but the total number runs to approximately 200. Each group leader conducts regular meetings of employee groups ranging in size from eight or ten to as many as 20, 30 or 40. The group leaders—a few of whom are women—also were chosen for their abilities in leadership. Their occupations range from line foremen and bookkeepers to department heads.

Group leaders deserve credit

In launching the information program it was believed that the group leaders would constitute the real moving force; that upon them and their work would depend the ultimate and continuing success of the program. And at this time there is every reason to credit these employee-leaders with whatever success has been attained in various phases of the plan. By reason of their interest in the program many group leaders have obtained recognition for themselves which they might not otherwise have received. In fact, for many of them it presented the very first opportunity to show that they were capable of doing things other than stringing wires, erecting poles, keeping books, selling appliances, operating buses or working over drawing boards. A great deal of attention has been given to the training of group leaders since the program began—and still more attention will be given to it in the future.

The purpose of the *general committee* in Atlanta is to draw together general department heads of the company to set out and to discuss certain necessary policies and procedures concerning the employee program. Responsibility for promoting and conducting the activity is lodged with the advertising department, and two members of that department represent the general committee in field contacts with division managers, sponsors and group leaders. These men are also responsible for preparation of bulletins for group leaders and sponsors, for keeping records regarding activities of the program and for rendering other obvious assistance of a general character. Still another member of the advertising department handles the important assignment of preparing informational folders for discussion in employee meetings.

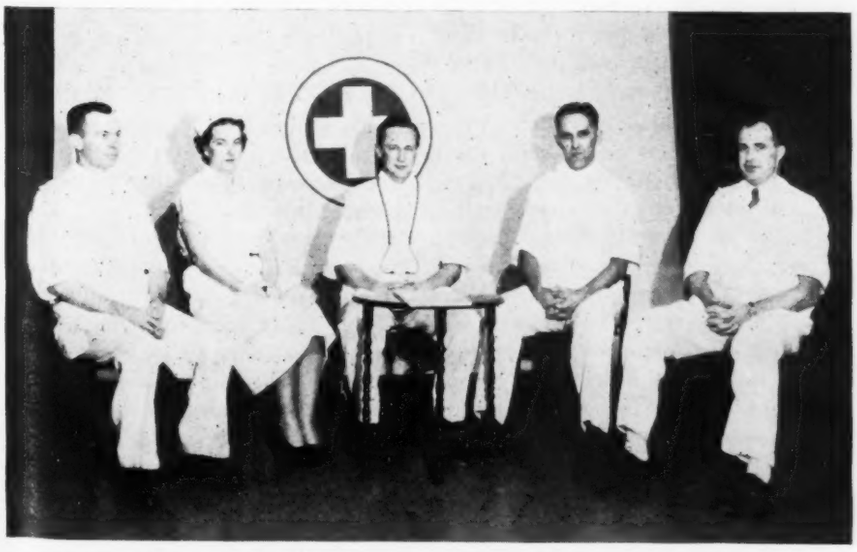
75 per cent active

Under the plan of operation for the employee program, employee groups meet twice a month for one hour. Although all meetings are held on company time, attendance is entirely voluntary, as is, of course, participation in any parallel activity of the program. Records indicate that at least 75 per cent of the 5,000 employees are active members of various groups.

Subject matter for discussion in the employee meetings is supplied through the regular publication and distribution of informational folders prepared at company headquarters. Folders are supplied for three out of four meetings; subject matter for every fourth meeting is prepared within each division. Among the subjects which have been discussed throughout the company are taxes, electric rate structure and application, the American business system, Georgia's resources, the company's financial condition, salesmanship, citizenship, electric meters, political accusations against the company, the company's rate valuation and tax valuation. During the past three months the employee program has taken up safety—the costs of accidents to every one concerned, the prevention of accidents in the home and office, first aid, health protection, automotive safety. Beginning this month Red Cross first-aid training courses have been made available to all interested employees. Qualified employees will serve as instructors.

Guest speakers

A meeting of the group leaders in each division is held in the early part of each month for the purpose of preparing the leaders for conducting their employee group meetings held later in the month. At the group leader meetings every effort is made to build up a "model presentation" of the subject at hand, in order that the group leaders may receive suggestions as to complete and effective methods for placing the particular subject before their individual groups. In addition to discussions of subject matter contained in the informational folders, parallel information regarding the subject also is presented. For example, in the study of electric meters the company's meter superintendent attended each group leader meeting and not only made a thorough talk on the subject but answered dozens of questions that cleared up misunderstandings of meter testing, meter reading, billing and other phases. Guest speakers from outside the company appear frequently on the group leader programs. Fundamentals of public speaking, memory training, the pub-



Five employees of the Macon division, Georgia Power Company, present "The Tragedy of Accidents," a one-hour skit on accident prevention

Shown in the picture are (left to right)—Ralph Greene, meterman; Miss Lonette Buffington, stenographer; Douglas Feagin, Jr., division claim agent and division sponsor for the Employee Information Program; Don Livingston, division meter superintendent and chairman, division safety committee; Asa Smith, commercial lighting salesman.

lic's attitude toward utility employees, Georgia agriculture and manufacturing have been among the subjects discussed by the guest speakers.

Some results

What have been the results obtained thus far from the employee program? Has it been worth the time and expense it has required? What has it done to create greater "company spirit"? What about its future?

Employees of the company generally now speak more intelligently and confidently to their friends and customers regarding the company's rates and services, its policies and problems. Prior to the employee program some employees say that they dreaded having their friends ask them about the company's operations. Now there seems to be a *desire* on the part of employees to discuss the company with their friends—because they have been equipped with interesting and adequate information about the company.

Employees have welcomed the frankness with which the company's financial problems have been placed before them. Having been taken more into the confidence of the management, they now feel themselves more definitely to be an integral part of the company.

There has been fine improvement in relations between departments inside the company. At some locations the employee program has developed a fraternal spirit the like of which had not been evident a year and a half ago. In the smaller towns fish fries, barbecues, dances and family parties have been held on several occasions in combination with the employee group meetings. These social affairs were arranged by the employees on their own initiative and paid for by them—not the company—because the employees wanted it that way.

One direct measure of the improvement in customer relations is the reduction in complaints. One district manager reported recently that the number of complaints now coming across his desk is fully 80 per cent less than a year ago. He says that individual employees now take it upon themselves to straighten out the majority of complaints. Heretofore, employees were inclined to say: "Well, you'll have to take that up with the district manager." Now they sit right down, then and there, and do their best to satisfy the customer's complaint.

A few months ago—under the sponsorship of the employee program—a questionnaire was mailed to each employee requesting the following information: "What three general complaints or criticisms regarding the company's rates, services or policies do you hear most frequently from customers of the company?" (We asked for 'em . . . and we got 'em!) About 1,000 answers were sent in, listing fourteen different types of complaints and criticisms. As a result, various causes of complaints were corrected and the employees gained valuable experience in studying the causes of customer dissatisfaction. Another, and more exhaustive, employee questionnaire is being prepared at this time. It will request of all employees their views on matters of company policy, their criticisms of company operations, working conditions and other pertinent matters, including their criticisms of the employee program itself.

One of the most interesting phases of the employee activity has been in the direction of training for public speaking. Last fall and winter employees in Atlanta organized two classes in public speaking, hired their own instructors and paid the instructors out of their own pockets. One of the classes met at 8 o'clock on Saturday mornings, although Saturday is a holiday under our five-day week. Other employees have gained training and experience by taking active part in their group meetings. They have learned to speak well by getting up and speaking.

ORGANIZATION OF THE EMPLOYEE INFORMATION PROGRAM

GENERAL COMMITTEE (Atlanta)
- President
- Vice-President & Gen. M'g'r.
- Vice-President in Charge of Sales
- Assistant to the President
- Manager, Advertising Dep't.
- The Six Division Managers

ADVISORY STAFF (Atlanta)
- Three Members of the Advertising Department

DIVISION MANAGER

DIVISION SPONSOR

DIVISION COMMITTEE
- Department Heads in the Division Office

GROUP LEADERS

EMPLOYEE GROUPS

During April and May attention was given to study of the American business system. The employee program played a prominent part in Georgia's participation in the "What Helps Business Helps You" campaign of the U. S. Chamber of Commerce. Many employees were invited to speak before civic organizations on this subject, and they are still being called upon. The instruction and practice which group leaders and other employees have received has developed a corps of employee-speakers who can stand on their feet and speak persuasively about matters concerning the company and other matters of public interest.

Broadens sales

Another indication that the employee program has developed a cohesive, effective organization was its success in sponsoring an all-employee sales campaign during the summer months, when approximately $75,000 in small electric appliances were sold, against a quota of $50,000. In that sale more different employees sold appliances than in any previous all-employee sale in the company's history.

An important outgrowth of the employee program was the recent organization of an executives' program, in which 100 executives of the company at general headquarters have been formed into two groups for regular monthly meetings. The leader of one group is the vice-president and general manager; the other is the vice-president in charge of sales. Vice-chairmen of the two groups are the treasurer of the company and the secretary. At their meetings the executives discuss the same informational material as the employee groups, as well as other matters of general interest.

The employee program isn't perfect, nor is it presented here even as a rough pattern by which any other public utility may wish to proceed. But it has done, and is doing, a good job. The management has great hopes for its future and for the good effect it may continue to have upon employees, upon relations with customers and upon the company's welfare as a whole. Begun as an experiment, it has already demonstrated its worth and has shown that it offers broad possibilities for constructive help in every phase of the company's activities.

Load Center Transformers Aid Factory Relighting

By W. J. LEEMHUIS
General Electric Company, Pittsfield, Mass.

REVAMPING of the production layout at the Pittsfield plant in keeping with the latest objectives of industrial output afforded an excellent opportunity to apply a new approach to obtaining economically adequate power for industrial lighting. Analysis showed that use of "Pyranol" transformers at strategic distribution centers made it possible to obtain the desired illumination at savings of approximately 40 per cent compared with oil-filled transformers in conventional locations. The saving was principally in the lesser cost of secondary copper and the smaller amount of conduit required.

Incandescent lamps are well known to be sensitive to voltage conditions. This is especially significant in industrial plants, where motors and electric heating equipment can readily give acceptable results with occasional voltage drops of 10 per cent. But, for the lamps, a 10 per cent loss in voltage on a 115-volt lamp will mean a loss of 31 per cent of the illumination it can give at normal voltage. Maintenance of proper voltage at the lamp sockets is too often overlooked because of the dominance in the past of the other less critical loads. But with adequate lighting for production, safety and employee contentment receiving its due consideration, the design of a factory distribution system involves new factors of economic layout.

Voltage adequacy at each lamp socket is a matter of size and length of feeder and branch circuit runs and of supplementary regulation provided. Here is where the balance of cost rests, between the cost of the circuit installation and the cost of the 3 per cent of illumination sacrificed for each 1 per cent of voltage drop. The cost of light should not be figured in terms of the outlay for the kilowatt-hours, but should factor the gains in terms of increased production, accident prevention and human welfare.

This is where the Pyranol transformer entered into the Pittsfield calculations because the Pyranol transformer can be installed near the points of application of the electrical energy, using primary copper for greater distances, and thus shortening the runs of secondary copper, which is ten times heavier on a 2,300/230-volt system. At the same time this load-center location of the transforming equipment makes it easier to provide the 50 per cent margin of increase in lamp size which future standards of illumination may well dictate.

Substation remotely located

In the Pittsfield plant in many cases the furthermost lamp socket was 500 ft. or more by wire from the conventional outdoor location of the former oil-cooled transformer substation. They had been wired for 100 watts per outlet, standard capacity at the time, and the conduit in many instances left no space for increase in wire size to meet the modern standard of 500 or 750 watts per outlet, which corresponds to the 6 watts per square foot of working area required to attain the present desired level of 25 to 35 ft.-candles.

To overcome this situation, be-

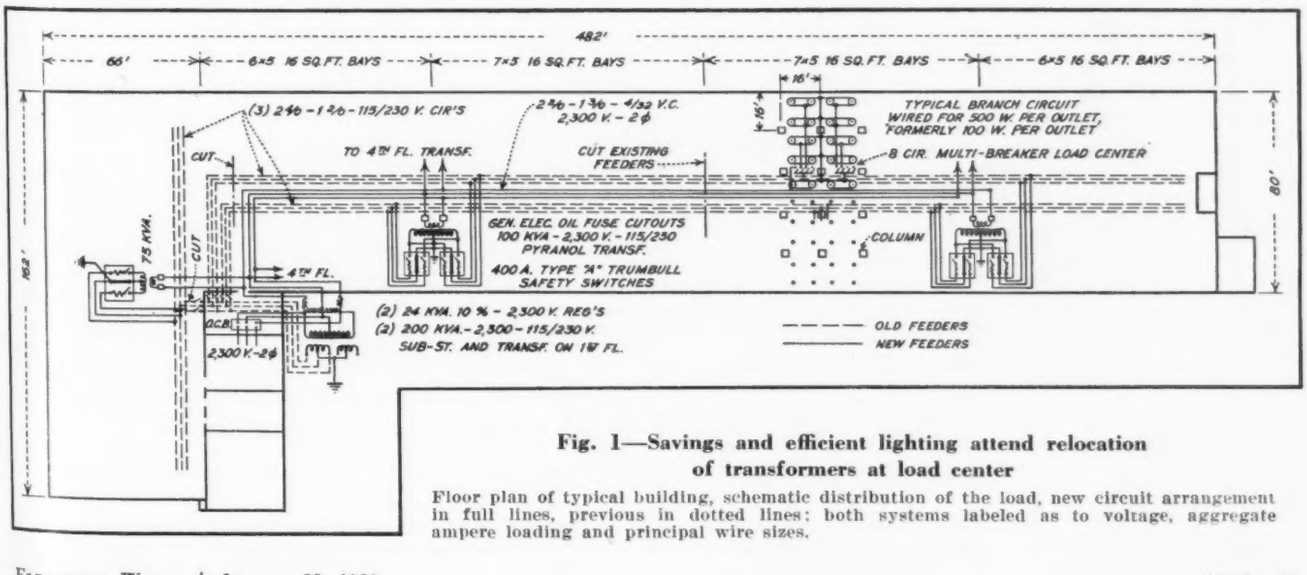

482'
66'
6×5 16 SQ. FT. BAYS
7×3 16 SQ. FT. BAYS
7×5 16 SQ. FT. BAYS
6×5 16 SQ. FT. BAYS
16'
(3) 2#6 - 1#6 - 115/230 V. CIR'S
2#6 - 1#6 - 4/32 V.C. 2,300 V. - 2ϕ
TYPICAL BRANCH CIRCUIT WIRED FOR 500 W. PER OUTLET, FORMERLY 100 W. PER OUTLET
TO 4TH FL. TRANSF.
CUT EXISTING FEEDERS
8 CIR. MULTI-BREAKER LOAD CENTER
CUT
75 KVA.
GEN. ELEC. OIL FUSE CUTOUTS 100 KVA - 2,300 V. - 115/230 PYRANOL TRANSF.
400 A. TYPE "A" TRUMBULL SAFETY SWITCHES
COLUMN
4TH FL.
OCB
2,300 V.-2ϕ
(2) 24 KVA. 10 % - 2,300 V. REG'S
(2) 200 KVA. - 2,300 - 115/230 V. SUB-ST. AND TRANSF. ON 1ST FL.
OLD FEEDERS
NEW FEEDERS
80'
152'

Fig. 1—Savings and efficient lighting attend relocation of transformers at load center

Floor plan of typical building, schematic distribution of the load, new circuit arrangement in full lines, previous in dotted lines; both systems labeled as to voltage, aggregate ampere loading and principal wire sizes.

lieved to be typical in many existing industrial plants, three plans were considered:

Plan No. 1—Increase five-fold the size of the existing 2,300-230/115-volt transformers at the substation. Abandon the conduit runs and feeders embedded in the building structure. Run larger conduit exposed.

This plan proved, as was anticipated, prohibitively high. Calculations of feeder sizes to limit voltage drops in them to a maximum of 2 per cent dictated the use of 2,000,000-circ.-mil cables. The conduit size would be 6 in. The cost was already high before even considering the conduit installation brackets, junction boxes and heavy cables.

But it did seem logical to consider using the existing secondary conduit for extending the primary feeder direct to the load center. This was plan No. 2.

Plan No. 2—Install a Pyranol transformer at the center of load distribution. The existing conduit could then be used for a 2,300-volt feeder.

This plan would not, however, avert the running of secondary feeders the length of the building just as in Plan No. 1. However, the permissibility of locating the Pyranol transformer (with its minimized fire hazard) at the middle of the building would permit much smaller size of secondary runs each way from the middle.

Analysis revealed that the cost of installation in accordance with plan No. 2 was approximately 80 per cent of that required for plan No. 1.

Plan adopted

As can be seen from Fig. 1, the original feeders and conduit ran the length of the principal building in question. If this feeder were separated into three equal sections, with a Pyranol transformer inserted at the center of each section, the feeder would be loaded at six places and only the minimum additional 230/115-volt secondary copper would be required to connect each transformer to its load center. This constituted plan No. 3.

Plan No. 3—Cut the existing secondary feeder into three sections. Install a Pyranol transformer at the middle of each section. Run new 2,300-volt feeder in exposed conduit to supply the transformers.

Since the transformer capacity required was three units each of 100 kva., instead of one unit of 300 kva., the cost for transformers was about 40 per cent more. But, again, the saving in copper offset this, which, combined with the saving in installing the longer primary run as compared with the greater amount of heavier secondary run, reduced the total cost to approximately 60 per cent of plan No. 1. Similar economies were found for other buildings in the group which presented comparable opportunities for modernization.

As a consequence Pyranol transformers have been installed in four areas (Fig. 2). Buildings A and B each has two 2,300-230/115-volt

[*Continued on page 78*]

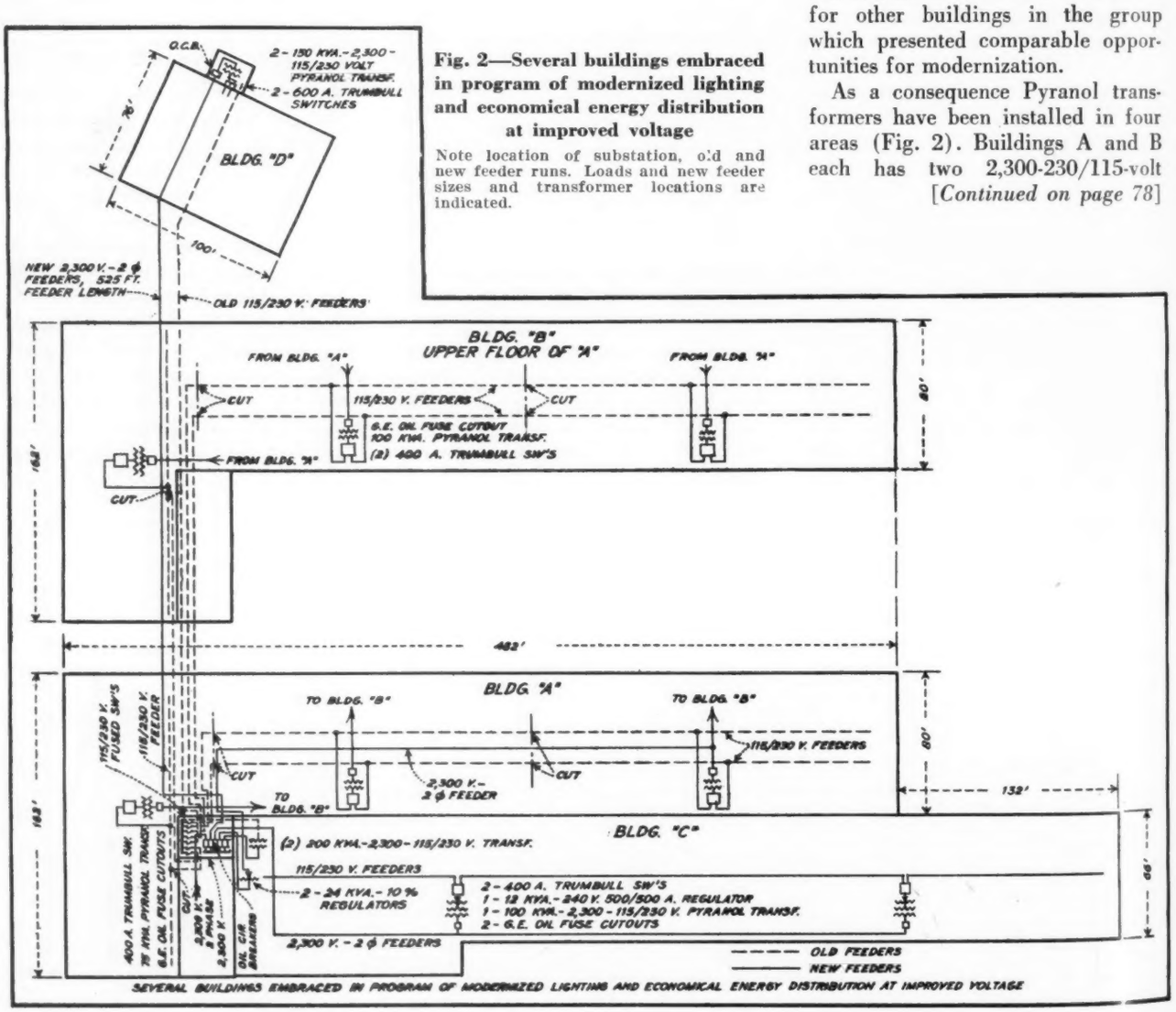


Fig. 2—Several buildings embraced in program of modernized lighting and economical energy distribution at improved voltage

Note location of substation, old and new feeder runs. Loads and new feeder sizes and transformer locations are indicated.

Heat Exchangers Cool Transformers

By J. ELMER HOUSLEY

Superintendent of Power, Aluminum Company of American, Alcoa, Tennessee

CERTAIN types of unit heaters have proved effective when functioning as heat exchangers to convert water-cooled transformers to forced air cooling. In a number of cases the installation was made to supplement water cooling which was inadequate because of the lack of a source of sufficiently cool water.

In one Southern plant there existed an unusual combination of reasons for supplementing the regular water cooling of sixteen 2,500-kva., three-phase, 13,200-volt transformers. The source of water was a spray pond and during the summer there existed a high ambient temperature and a high relative humidity which effectively prevented the cooling of water below 95 deg. F. The transformers were operated at 100 per cent load factor and at 5 per cent over-excitation. As the transformers were of the type having air above the oil surface, the rate of oxidation of the oil was high.

A decision was made to use supplementary cooling, which would remove about the same quantity of heat as was removed by the water-cooling coils supplied with 95 deg. F. (35 deg. C.) water. This additional amount of cooling was necessary to reduce the operating temperature of the top oil from 63 deg. C. to not more than 55 deg. C.

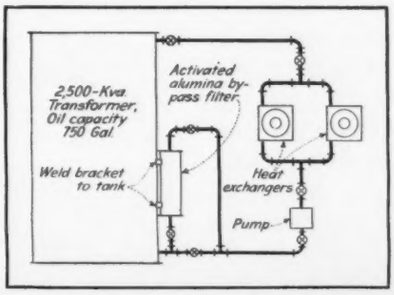


Fig. 1—Transformer cooled by heat exchanger

The air circulating fan is driven by a 1/6-hp., single-phase motor operating at 1,140 r.p.m. Oil from the top of the transformer flows through the cooler into a motor-driven pump which delivers the oil to the lower drain connection of the transformer. The transformer contains 750 gal. of oil. The pump has a capacity of 35 gal. per minute, operating at a head of 26 ft., and is driven by a 1/2-hp., single-phase motor. Motors and other equipment are of the outdoor type.

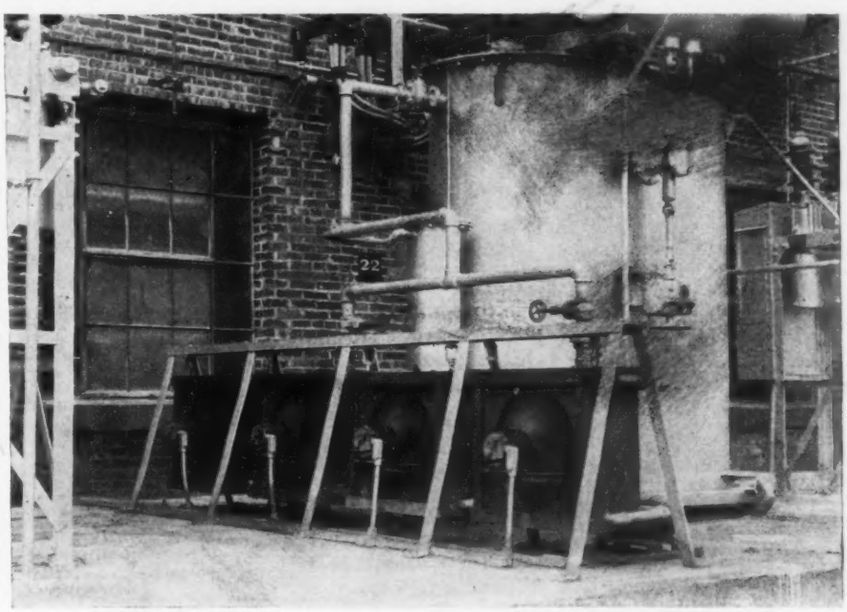


Fig. 2—Duplicated installation compensates for shortage of cooling water

Two groups of two "Thermoliers" in parallel and one pump for each pair of unit heat exchangers.

Installation saves

It was recognized that a unit heater should be selected which was in quantity production in order to secure the resultant economy in price. A minimum of two units was desired in order that the entire installation would not be shut down during the period required for oiling the motor, cleaning the external fins or other repairs and adjustments. Furthermore, one unit in operation is sufficient except during the period of maximum temperature. During the winter the entire supplementary cooling system can be taken out of service. The heat exchangers chosen to supply the cooling (Fig. 1) are of the forced air radiator type with a 19-in. fan having a capacity of 2,016 c.f.m. of air at entering temperature of 60 deg. F.

Had the conventional water-cooling coils of larger capacity been installed in the sixteen 2,500-kva. transformers, previously mentioned, the cost would have been $827 each. The cost of the supplemental cooling installation, consisting of two unit heaters and one pump, which were applied to the same transformers in the manner previously described, amounted to $385 for each transformer.

Additional capacity being required for plant operations, it was necessary to install two additional transformers of 2,650 kva., 13,200 volts, three-phase. This installation took place when there was an inadequate supply of water and therefore four unit heaters (Fig. 2) of the same size as pre-

[*Continued on page 76*]

Editorials

S. B. WILLIAMS, Editor

Tide of Rate Reductions Ebbing

THE figures in our January 14 issue on rate reductions as reported by thirty public utility commissions are most amazing. While it has been apparent that there were fewer reductions and these were of lesser magnitude, it did not appear until these figures were compiled that the reductions aggregated about one-third those of the previous year in point of savings to customers.

Have we about reached the end of the wave of rate cuts? It would seem that perhaps we have when we consider how almost universal rate cutting has been and how much costs, including taxes, have gone up. There will, of course, continue to be numerous instances of rate changes, but in general it seems reasonable to believe that fairly stable rates can be expected for some time.

In fact, the data show conclusively that the greatest financial benefit to the customers comes not from rate cuts, but from earned lower rates through increased consumption. If commercial efforts will result in a large percentage of customers going into the next step of the rate, it may be possible to eliminate formal rate reduction for some time, leaving to the customer the opportunity to set his own rate.

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The More Complaints the Better

IF CUSTOMER complaints are few, is that a good or bad sign? There are some people who would say that the fewer the complaints the better the service, but is that really the case? The actual number of complaints is not necessarily an index of cause for complaint. The attitude of the company in adjusting trouble over a period of years may have discouraged customers. And then there is a large group of people, probably the largest of all, who would hesitate to complain to the company, but who would nevertheless tell others.

Customer complaints are frequently the only way of finding weak spots in the company's system of doing business and in certain of the personnel. No organization can do its job without some mistakes, but unless the customers complain there can be no control. In a large company there are literally hundreds of things that can give a customer cause for complaint. Smaller companies may have less. The point is, however, that each of these complaints, if not caught and adjusted, can breed ill will. And the unadjusted complaint of one man added to one of his neighbor makes two for each.

On the other hand, complaints satisfactorily adjusted can bring good will and friends. Every complaint can be a potential asset if properly handled. On that basis, it would seem that every effort should be made to dig out complaints, even if it means sending out field men to call on the customer.

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Working With REA Co-operatives

AS WAS shown in these columns two weeks ago, REA is now serving 150,000 rural customers from 70,000 miles of line, and the score is increasing rapidly. With few exceptions, these lines buy their wholesale supply from private power companies. What attitude is the industry going to take with respect to them? Is it going to let the co-operatives work out their own solution or, because they are customers, is the industry going to try to help them become better customers?

Many people are taking the attitude that these co-operatives can never pay for the lines and that sooner or later they will seek the assistance of the utilities to help them out of their difficulties. There can be no question but what a great many of these lines will not pay out. Probably the time will be lengthened, and then some day another administration in all likelihood will cancel the debt. And even then some of the projects will find it difficult to make both ends meet.

But assuming that a large number of these REA lines will sooner or later become power company lines, it would be infinitely better if the load was up and the lines in good condition. Power company assistance can do much to help this condition.

On the other hand, these lines may stay in the hands of the co-operatives. They are customers. By helping them they can become better customers. In fact, there might be more profit, at least during the first several years, in supplying the wholesale load than if the rural customers were on the lines at retail rates. And in helping the co-operatives, there is created an element of good will for the company that is entirely lacking today. All through its activities REA has done its best to destroy farmer good will toward the power industry. The farmer, however, is not blind, and much that has been lost might be regained by co-operation with him.

There might be worse situations than customer co-operatives. They might use Diesels. On the other hand, if a power company is working with them, it has the inside track and can protect its load.

Code Revision Can Be Harmonious

THE eight proposals being made by the power company group for changes in the next edition of the National Electrical Code have not had an enthusiastic reception.

For years proposed Code changes have been discussed on the basis of the effect on safety. Looking back upon some of the most bitterly fought changes, it must be apparent that very little is known about minimum safety requirements as applied to safety. Aside from changes arising within the inspector group and dictated by field experience, commercial considerations are largely responsible for revisions. When such proposals involve minor modification of the rules, a decision is reached quickly upon the merits of the case. Where the proposals would mean major changes in practice or method resistance arises, based not upon the merits of the proposals, but upon commercial partiality. While easily understandable, it is nevertheless unfortunate becaue it leaves the impression that the Code is restrictive and therefore not in the interests of invention and progress.

And it is unfortunate for another reason. Generally speaking, new methods, if they do have merit, are in the long run accepted in the Code. In the meantime, a bitter fight has been waged and wounds, some of which never heal, have been inflicted. Surely there must be some approach to the introduction of new methods in wiring practice that will obviate this unfruitful acrimony.

Proposals for substantial changes as a rule originate either in the power company group or with a manufacturer of a new device or method and the battleground for votes is at once the inspectors. These men, who constitute the largest individual group of votes in the N.F.P.A. Electrical Committee, are supposedly uncommercial, unbiased, viewing suggested changes purely on their merit as affecting wiring safety. However, there is some suspicion that inspectors who still carry their I.B.E.W. cards or who owe their jobs to union influence have their viewpoint colored by the labor angle.

And that is the situation that is facing the eight power company proposals at the present time. Labor is opposed because labor has always been strongly pro-raceway wiring, on the theory that it involved maximum employment of labor. And nobody has as yet sat down with labor to explain the economic merits of the proposals with respect to labor.

In our opinion, labor is too smart to bite off its nose to spite its face. As an organization for mutual protection, it is naturally going to oppose anything that it thinks is not in its interest. On the other hand, if the contention of the power group that the proposals involve more labor by opening up new markets are valid, then labor would be hurting its own cause not to espouse them.

Although labor is not directly represented upon the electrical committee, labor's influence is becoming stronger. Those who do not recognize this strength are apt to find the going a little difficult. If labor is approached in the beginning sincerely, it is not improbable that much of the difficulty that besets the path of a new wiring method in gaining Code acceptance could be minimized.

There can be no question of safety in these proposals. The utilities do not want unsafe wiring upon customers' premises. It all boils down, then, to this: Will the proposed changes, all or any of them, make it possible to sell more wiring in new or old buildings, and thereby help all concerned, or will it not. As soon as the facts are ready, and they are now being prepared, they should be discussed with all interested groups and a mutually satisfactory answer found.

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Critical Rates

WHAT is the critical point in residential rates below which the more energy sold the greater the loss? Is it possible ever to arrive at this point for the industry as a whole, or even for a single system? Will not conditions vary from system to system and even within systems? And who knows definitely how much of the cost to allocate to any one service?

Unquestionably studies of the effect of certain rates upon net revenue are much to be desired. Such studies will have the effect of preventing the introduction of unprofitable promotional rates. Unlike other business, where too low a price can be corrected as soon as it is discovered, utility prices are ratchet in effect—easy to reduce, almost impossible to raise. It is essential, therefore, that when new rates are made there be no mistake.

On the other hand, to set up two cents or any other figure as the critical point might be embarrassing, in that it might prevent the development of some essential load or limit the possibilities of meeting competition. If we assume that things are going to stay as they are, then it might be possible to name some figure as representing the danger zone, the closer to which a rate comes the greater the necessity for assurance that it is right. Under a new set of conditions, however, such a critical rate must not be a business deterrent unless it is positive that new economies of operation cannot be found to balance.

Those who are making studies in this direction are to be complimented on the excellence of their work. They are rendering the industry a great service. From their findings should come better balance of load-building activities as well as co-ordination with system operation and construction forces.

Vermont Looks at Power

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

NAZI censors were asked, a few weeks ago, why it was that the bookstores in Berlin were allowed to display and sell the memoirs of Count von Bernstorff, former Ambassador to the U. S. The wonder was caused by the fact that the book takes several severe falls out of the Hitler régime.

"Why," the chief censor smiled, "that book sells for 10 marks. We are not worried about any one who can afford to pay 10 marks for a book. If it sold for 1 mark, now, we would be obliged to suppress it, and if it sold for half a mark we would have to take severe disciplinary steps."

"That's the reason," the man who asked the question declared later, "there is no hope for any revolutionary movement against Hitler. The people who are against him, who know his economics and military ambitions are cockeyed so far as any real benefit for Germany are concerned, are those who can afford to buy a 10-mark book. They are people who think. They remember the World War and they understood the silly economics and inflation which followed it. But they are in a hopeless minority."

Majority are havenots

It happens that more Americans, proportionately, can afford to pay the equivalent of 10 marks for a book, but it is unfortunately true that even in the United States the havenots are the great majority, and one may be permitted to wonder if the psychology of the New Deal—particularly with regard to its treatment of the electric industry—is not based on the same fundamental philosophy as that which actuated the Nazi censors. One might be forgiven for suspecting that the New Deal is not any more worried about what the folks think who can afford 10 marks for a book than are Hitler's minions, but that a tremendous concern is felt for the mental process of the folks who would regard 1 mark as plenty for any volume.

For example, it is difficult to imagine any one who would pay 10 marks for a serious book believing that it was right for a government to use physical force to prevent the free expression of opinion. But it is also difficult to imagine such a person thinking it was right for the government to tax all the people, and then bribe certain communities, with that tax money, to do something they otherwise would not want to do. Or else to withhold federal funds, earmarked for public works intended to save life and property in times of disaster, unless the communities affected would give in to the federal authorities, and sacrifice their principles in order to get the necessary protection.

Just that very thing is going on in the relations between the state of Vermont and the New Deal in the matter of flood control and power. It so happens that the headwaters pour into rivers, particularly the Connecticut, which causes flood damage all the way down to Long Island Sound, occasionally doing much damage in Massachusetts and Connecticut. So it was agreed that flood control in Vermont was a matter, not for Vermont alone, but for the federal government.

The Administration agreed with this contention, and was about to proceed, until it discovered that Gov. George D. Aiken of Vermont was determined to preserve, for Vermont, control of the power which would be generated. Both sides being unyielding, one might think that this was a question which might very properly be arbitrated by the courts. For some reason, however, the New Deal does not want to test this case in court. One may be pardoned for drawing deductions from this.

But the Administration is very bitter against Governor Aiken. One may judge how bitter by reading the remarks on the floor of the House by Representative John Rankin of Mississippi, head of the public ownership bloc in the House. Rankin's remarks are always worth studying, as they have a value entirely out of proportion to Rankin's personal power. It is Rankin who says what the President, and even Senator George Norris, are not willing to say out loud.

Rankin's apparently wild statements of any given day—so far as the electric industry is concerned—have been proving a sure tip to what the Administration would be found doing a little later. Rankin denounced Governor Aiken as a candidate for president, financed by the big utility interests. It so happens that Aiken has been mentioned as a liberal Republican possibility for president just often enough so that the chap who can pay only half a mark for a book would take this charge very seriously, especially when it comes to him in a free Congressional Record, under a government frank.

Thrust at Governor

So the half-a-mark book voters in Vermont will be deluged with propaganda that a beneficent government in Washington is eager to spend a lot of money in the Green Mountains, which would not only make good business for the thrifty citizens of Coolidge's native state, but would prevent floods, and that the only obstacle is this hireling of the power trust who sits in the Governor's chair.

The mere fact that Vermont happens to be paying more into the federal treasury than it takes out—that Washington is trying to buy the Green Mountain boys with part of their own money, of course is not brought out. But under the present powers granted the President there

[*Continued on page 71*]

News OF THE WEEK

A.I.E.E. Winter Convention Draws Large Attendance During Program

Engineers from all sections discuss technical problems and development during meeting in New York — President Parker tells Institute it would concern itself with economic factors on technical problems

Electrical engineers from all sections of the country gathered in New York this week for the winter convention of the American Institute of Electrical Engineers. An elaborate program of seventeen technical, two general and five conference sessions was held, in addition to important committee meetings.

Attendance was more than 1,200 during the week.

John C. Parker, vice-president of Consolidated Edison and president of the A.I.E.E., said that it seems "eminently proper, indeed unavoidable, that the Institute should concern itself with the impingement of economic factors on technical problems and that the members of the Institute should have made available to them every stimulus to a fuller awareness not only of the economic but of the social implications of the work of the engineer."

He said that the particular knowledge of the engineer and the engineering method of approach are of extreme value and should be available to society in the meeting of each of its problems which has an engineering content.

Experiments with a new means of insulating power transmission lines by the use of compressed gases such as helium and nitrogen were reported by Alvin H. Howell of the Massachusetts Institute of Technology. Mr. Howell described research tests in which 500,000 volts of direct current were sent through conductors insulated only by a blanket of compressed gas which had been forced into a surrounding tube. He noted that the gases, because of their low cost and the high degree of insulation provided, might replace expensive insulation now used on high-voltage electric lines and reduce the cost of transmitting power.

President John C. Parker

The permatron, a magnetically controlled industrial tube, for which many new industrial applications are expected, was described by W. P. Overbeck of the Raytheon Production Corp., Newton, Mass. The usefulness of the permatron, Mr. Overbeck said, extends to a new field of application. He said that most of

ENGINEERS CONVENE—Seen at the A.I.E.E. meeting this week were, l. to r.—C. R. Jones, C. A. Powel and Frank Thornton of Westinghouse Electric & Manufacturing Co.; Prof W. H. Timbie, Massachusetts Institute of Technology; F. Maxwell Jr., University of Alabama, E. D. Wood, Louisville Gas & Electric, and H. H. Henline, secretary of the A.I.E.E.

AT A.I.E.E. MEETING—Among the engineers at the midwinter convention were, l. to r.—E. C. Crittenden, National Bureau of Standards, and F. M. Farmer, Electrical Testing Laboratories; George Steeb and M. K. Brown of Buffalo, Niagara & Eastern Power; L. J. Audlin, Central New York Power; H. P. Seelye and L. W. Clark of Detroit Edison

the development so far has been confined to small and medium power industrial tubes, with ratings of from 0.1 to 8 amp. and up to 3,500 volts.

"There is, however, no factor," he said, "which prevents application of the same principles to tubes of higher voltage and current ratings."

The A.I.E.E. noise committee found that the practical definition of effective sound level is a statistical definition. The committee said that it is an average of values taken at suitably chosen points around the apparatus being measured.

Tentative standards for sound level meters have been set up by the standardizing committee. It was said that the sound level meter is, and probably will continue to be, intrinsically a much more complex device than the current reading meters.

Fritz and Edison Medals

Dr. Dugald C. Jackson, professor emeritus of electrical engineering, Massachusetts Institute of Technology, was awarded the 1938 Edison medal of the A.I.E.E., the highest award in electrical engineering. The award was made to Dr. Jackson for "outstanding and inspiring leadership in engineering education and in the fields of generation and distribution of electric power." He was president of the A.I.E.E. in 1910-11.

The 1939 John Fritz medal, the honor awarded by representatives of four national engineering societies, went to Dr. Frank Baldwin Jewett, vice-president of American Telephone & Telegraph Co., president of Bell Telephone Laboratories and former president of A.I.E.E. He received the award for his "vision and leadership in science and for notable achievement in the furtherance of industrial research and development in communication."

During the convention members of the institute made inspection trips to the Columbia University Cyclotron, the Jacob Ruppert brewery, to the fluorescent lighted railroad car and portable battery charging rectifier of the New York Central Railroad, the sponsored broadcast of Consolidated Edison Co. of New York, and one of the Cities Service Company, to the automatic substation of the I.R.T., the Westinghouse Electric & Manufacturing Co. works at Bloomfield, Jersey City and Newark, N. J., the Essex generating station of Public Service Electric & Gas Co., Newark, N. J., the Electrical Testing Laboratories, the New York Stock Exchange, Western Electric cable and apparatus plant at Kearny, N. J., a trip to the World's Fair and to the *Daily News* plant.

At the dinner honoring the "outstanding young electrical engineer of 1938," held under the auspices of the Eta Kappa Nu Society, the honor went to Dr. Winston Kock of the Baldwin Piano Co., Cincinnati, who was selected for the award by a special committee. Honorable mention awards were presented to Harold Gove of the Union Electric Co. of Missouri, St. Louis, and Dr. G. M. L. Sommerman of the American Steel & Wire Company, Worcester, Mass.

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Installs 1,000-Kva. Unit

Wisconsin Public Service Corp. has installed a new 1,000-kva. capacity transformer bank at Denmark, replacing the former 300-kva. installation. The new substation equipment has also been fitted with voltage regulators. It is connected with the 33,000-volt transmission line from Green Bay to Manitowoc and can be fed from either city over two circuits.

Utility Withdraws from Nebraska Deal

Iowa-Nebraska Light & Power Co., a subsidiary of the United Light & Power Co., announced this week that it had withdrawn "entirely" from its agreement with the Nebraska Tri-County and Loup Public Power Districts for the sale of electric properties to the power districts for $20,195,591. The proposed transfer had received the approval of FPC in December.

In announcing the termination of the agreement, the utility company said the cause of it was the inability of the Nebraska power authorities immediately to finance the purchase of the properties. Recent developments in Nebraska over the issue of taxes and also control over rates created much uncertainty in investment banking circles, with the result that the power districts find it impossible to finance the purchase of the private utility's facilities. Municipalities raised the question of taxes to be levied on the properties under public ownership, compared with taxes collected from the private company. In addition, there has been much dissension as to who is to determine and regulate rates.

The power projects had contracted to sell revenue bonds to the Bancamerica-Blair Corp. to finance the purchase of the private properties. The issues were to mature serially from 1939 to 1968, interest at 3½ to 4 per cent.

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Changes to A-C Current

The Itta Bena light and water plant at Itta Bena, Miss., has changed from the old 220-volt direct current to alternating current. The plant has been remodeled recently and new machinery has been installed.

Insulation Problems Reviewed at Doble Engineering Meeting

Progress in test methods encourages operating engineers — Instrumental developments strengthen technique of fault detection — Manufacturers' sessions feature transformer and bushing designs

More than 100 operating electrical engineers from utility and manufacturing organizations in the eastern half of the United States met at Boston last week at the sixth annual conference of Doble Engineering Company clients for a six-day discussion of problems of insulation from laboratory and field viewpoints.

Some 25 papers by staff members and clients were supplemented by presentations of manufacturers covering developments in oil refining, conditioning and research, transformers and bushings.

Lower power-factor

It was brought out that there is a marked trend among operating companies to lower power-factor rejection values in bushings from arbitrary 8 and 10 per cent values toward the 3 to 6 per cent values based on correlated field tests and experience. This indicates that the bulk of extremely high power-factor equipment has been removed from the operating picture with consequent ability to work to closer limits economically.

Oil insulation research is becoming very active and oil tests are expanding to include many more criteria than the generally accepted voltage breakdown tests. As yet wide differences in standards of acceptance exist in oil insulation testing.

An investigation of condenser type bushings indicated that a large percentage of those with high charging currents can be economically repaired provided precaution is taken to prevent future uneven deterioration. Progress has been made in classifying transformer insulation faults by test current values.

One author reported that a rise in current values of 10 per cent or more, accompanied by a power-factor gain of 2 to 8 per cent, indicates the presence of moisture in the winding insulation. A winding power-factor rise of, say, 2 to 5 per cent or more with less than 10 per cent current rise points to the presence of high power-factor oil or a concentrated fault, like a bad bushing.

Reconditioning of bushings has made notable progress, it was reported. One system discovered that the dependable life of more than 80 per cent of its bushings in the 37-kv. class had been reached. The alternative to replacement at $75 average cost was to start a reconditioning program to run about four years. Initial work along the latter line showed that dielectric values after reconditioning were much better than expected; that mechanical difficulties were easily overcome, and that the program could be carried along economically with the regular maintenance work.

Another property reported expedition of shop reconditioning of bushings by utilizing the lately developed Doble type "U" tester, which measures watts loss and charging current at a given applied voltage, from which power-factor may be calculated.

Generator testing, according to another author, continues in a developmental stage as regards insulation check-ups. Moderation in high-voltage tests and continued search for coordination with other tests, such as watts loss, is advocated. Research on ionization is greatly needed to overcome difficulties in locating points of high concentration.

Studies of power-factor tests on varnished cambric cables indicate that al-

DOBLE MEETING—View of the general sessions is shown below. At right, l. to r. —Dr. W. A. Gruse, Mellon Institute; E. L. Schlottere, Philadelphia Electric; O. E. Fawcett, West Penn Power, and I. W. Gross, American Gas & Electric

though the power factors have been exceptionally high as compared with those of good bushings and transformers, the cables have withstood rigid high-potential tests.

Contributors to the program included W. J. Bridegam, Utility Management Corp.; E. W. Whitmer, J. R. Davis, W. L. Webb and F. D. Brook, American Gas & Electric; J. A. Rawls, Virginia Electric & Power; E. L. Schlottere, Philadelphia Electric; C. B. Wisbon, Toledo Edison; O. E. Fawcett, West Penn Power; H. M. Wade, Indianapolis Power & Light; G. G. Law, Dayton Power & Light; J. H. Merriam, Northern States Power; C. F. von Herrmann, Jr., Alabama Power; H. A. Cornelius, Public Service of Northern Illinois; A. E. Flowers, DeLaval Steam Turbine; Dr. W. A. Gruse, Mellon Institute; J. D. Harper, Aluminum Company of America; H. M. Doerschuk, Carolina Aluminum Co., and L. M. Munro, H. A. Walsh, E. H. Povey, F. S. Oliver, Dr. R. H. Marvin and G. H. Browning, Doble company.

Representatives of General Electric, Westinghouse, Allis-Chalmers and Ohio Brass also participated in the manufacturers' sessions where progress in transformer and bushing design and construction were featured.

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Protest Tax Assessments

Illinois-Iowa Power Co. has filed suit in Circuit Court in Belleville, Ill., to compel St. Clair County officials to reduce by 20 per cent tax assessments on its personal property.

Boston Edison Gains in Air Conditioning

Gratifying progress in the growth of air conditioning on the Boston Edison system since 1932 featured introductory remarks by Julius Daniels at a recent Boston Bureau meeting at the Hotel Kenmore, with about 200 members and guests present. Mr. Daniels pointed out that in spite of business upheavals the air-conditioning load has increased lately between 2,000 and 3,000 hp. a year, until at present it totals about 17,723 hp.

Mr. Daniels said that before 1932 there was 4,056 hp. in air conditioning in the territory. Since then the following growth in horsepower has taken place:

	Cumulative Growth (Hp.)	Yearly Increase (Hp.)
Before 1932	4,056	
1932	4,168	112
1933	4,684	516
1934	7,439	2,755
1935	9,615	2,176
1936	12,362	2,746
1937	14,723	2,361
1938 (estimated)	17,223	2,500

The number of installations in 1938 increased about 30 per cent over 1937, the horsepower added being about the same. This indicates the wide scope to which air conditioning is expanding in the smaller business establishments.

"Far from being a 'closed' industry," said Mr. Daniels, "air-conditioning manufacturers and dealers purchase, besides engineering and merchandising ability, many different products. With about 35 per cent of the cost of the average installation represented in compressors and 20 per cent for ducts, the metal industry is one of the largest recipients of this business. Makers of heat transfer units supply another 20 per cent and the electrical manufacturer obtains about 10 per cent in motors and wiring. Fans, filters, refrigerants and insulation are also required in substantial totals, while no small part of the total cost goes to labor and transportation units.

"At present," Mr. Daniels stated, "this market has reached a total volume of about $80,000,000 annually in this country. Executives in the industry predict that the total volume will exceed $350,000,000 in the next decade."

AIR CONDITIONING—Boston Edison reported a connected load growth from 4,168 hp. in 1932 to 17,723 hp. at present in air-conditioning equipment at the recent dinner meeting. L. to r.—Col. F. H. Payne, Greenfield Tap & Die Co.; Charles Penrose, vice-president of Day & Zimmermann; Julius Daniels, Boston Edison; President Karl T. Compton of M.I.T.; Willis H. Carrier, Carrier Corp.

•

Roosevelt Asks Congress to Revise Quoddy Project

President Roosevelt has asked Congress to renew consideration of the proposed tidal power project in Passamaquoddy Bay and the construction of the Florida ship canal.

In a letter to Chairman Mansfield of the House rivers and harbors committee President Roosevelt pointed out that existing surveys are insufficient and requested that an appropriation be made to complete test borings at the Passamaquoddy project. He asked that the advisability of putting in a small experimental power plant on the American side of the border be determined.

•

Nashville Asks for Vote to Distribute TVA Power

Another thrust to expand the network for TVA power distribution is being made in Nashville, where Mayor Thomas L. Cummings is asking the City Council to authorize a referendum election during the city election in May. It is proposed that Nashville either build its own distribution system or purchase the existing properties.

J. A. Krug, TVA power planning engineer, announced that progress has been made in working out a power contract for Nashville.

•

New Labor Vote Necessary

The NLRB election to determine the collective bargaining agent for employees of Consumers Power Co. has failed to bring a majority vote and a run-off will be necessary. The CIO's Utility Workers Organizing Committee received 1,164 votes, the A.F. of L.'s International Brotherhood of Electrical Workers 1,072 votes and there were 506 votes against both unions.

California Utility Plans Building Budget of $2,038,900 for Year

San Diego Consolidated Gas & Electric has increased steam station work to $600,900 and distribution to $946,000 — Will emphasize load building — Company sold $3,000,000 of appliances

Gross construction expenditures of San Diego Consolidated Gas & Electric Co. this year will total $1,744,900, plus $294,000 for maintenance. Last year the company spent $1,148,000 for new construction and $290,000 for maintenance.

The company this year is planning to spend $600,900 on steam stations, as against $181,000 last year. The major item in the budget is for distribution, where $946,000 will be spent, against $800,000 in 1938. The company has increased its budget for transmission work from $41,000 last year to $146,000 this year.

Emphasize load building

While new construction and improvements to the system occupy prominent places in the program for the year, a great deal of emphasis is being placed on load building. Appliance merchandising will be promoted during every month of the year.

Last year the company sold $3,000,000 of appliances which produced an estimated annual revenue of $273,000, according to A. E. Holloway, vice-president in charge of sales. The company expects to do about the same in dollar sales, but obtain a higher amount of revenue due to increased sales of electric ranges and water heaters.

As a result of co-operative efforts of all electrical merchandising dealers, together with company sales, the following appliances were sold during 1938, with estimated sales for 1939:

	1938	1939
Radios	12,500	12,000
Refrigerators	7,700	7,500
Ranges	650	800
Water heaters	600	700
Washers	4,200	4,200
Ironers	725	800
Vacuum cleaners	2,800	3,000
Hand irons	5,750	5,500

The utility is continuing its active program of expanding service into rural and farm areas. At the end of 1938 the company was serving a total of 5,458 farms, a gain of 225 during the year. Based on the 1935 census of total farms in San Diego County, the company had a saturation of approximately 90 per cent of farms served with electricity.

Records show that the company had 14,582 rural electric customers as of November 30, 1938, a gain of 1,127 during the year. Of this gain, approximately 680 were served from new line extensions in rural territory which totaled 55 miles. It is anticipated that another 50 miles of rural lines will be added in 1939 to serve 600 new rural customers.

Cut rates $1,060,000

While the company has been expanding its electric service it has not overlooked rate reductions. A cut of $168,000 was put into effect at the end of 1938. This was the fifth reduction in the past four years and affects a cumulative annual reduction of $1,060,000.

An unusual promotional activity was carried on by the company last year. A combination show and demonstration was held for the benefit of laundry equipment, with emphasis on ironers. During the three-day affair a large attendance was at every demonstration. By actual count 3,000 people were induced to sit down and iron a hand towel, which was then presented to the ironer. It was felt that this promotion aided in the sale of electric ironers.

Sales of appliances during the spring fair, with attendance reaching 78,000, were highly satisfactory. The recently concluded sixth annual electrical show drew 102,000 people and established buying records never before approached.

Another promotional activity which drew outstanding interest was the radio referendum held last October. More than 10,000 radio logs were distributed to people who secured ballots. Best of all, the company stated, it increased traffic on the floors of dealer stores and materially aided in stepping up sales. The same type of promotion will be carried next October.

•

Georgia Power Opens First 1939 Major Appliance Drive

Georgia Power Company has set $170,000 as the quota for the "Thirty-Niner" major appliance campaign, which began January 16 and ends February 20. Company is concentrating on Westinghouse ranges, water heaters and refrigerators and Lindemann & Hoverson ranges and water heaters this year.

In the final sales campaign of last year, the "Selectrical" gift campaign, sales totaled $83,984, or 129 per cent of quota, as against $79,417 in the 1937 Christmas gift sale. For the year commercial appliance sales of the company were $282,923, or 81 per cent of quota.

•

Edison Illuminating Group Elects Sawyer President

H. M. Sawyer, vice-president of the American Gas & Electric Co., has been elected president of the Association of Edison Illuminating Companies. Mr. Sawyer has been identified with the public utility industry since his graduation from Cornell University in 1911.

In that year he joined the Scranton Electric Co. at Scranton, Pa., as junior power engineer and the following year he went to Wheeling in the capacity of power engineer for the Wheeling Electric Co. It was in 1920 that he became assistant general contract agent for the American Gas & Electric Co. in New York, advancing to the position of general contract agent four years later. He was elected to a vice-presidency in 1928.

•

TVA Power Revenues Show Sharp Gain in Six Months

Revenue of TVA from the sale of electric power during the last six months totaled $2,615,000 and exceeded by more than $300,000 the revenues for the entire 1938 fiscal year, John B. Blandford, Jr., TVA general manager, announced.

The TVA sold 806,800,000 kw.-hr. from July 1 through December, as against 699,360,000 during the 1938 fiscal year. Municipal and co-operative wholesale customers paid an average of 4.99 mills per kilowatt hour during the last six months, as against an average of 5.57 mills during the prior year.

Reject Memphis Bid for Utility Plants

Memphis Power & Light Co. last week rejected the offer of the city to pay $18,127,000 for its electric and gas facilities, reiterating its claim that the price was not a "fair price for the properties."

In a letter to the Board of Light and Water Commissioners, W. J. O'Brien, president of the utility, also turned down the alternative proposition of the municipality to pay $13,500,000 for the electric properties, provided the gas rates were reduced. Declaring that the present gas rates "compare favorably with natural gas rates in other cities similarly situated to Memphis," the letter added that the company found it "impossible" to cut them, though it was ready to proceed with the agreement with respect to the sale of the electric properties.

If the city stands by its present offer, the letter continued, "the only course open to us is to submit this proposal to our security holders without any recommendation."

Following the utility's refusal, officials of the city commission announced that construction of the publicly owned system would go ahead. A contract for $349,709 for overhead distribution circuits was awarded to the Howard P. Foley Co. of Baltimore and one for $93,404 for underground ducts to the Harrison Wright Co. of Charlotte, N. C. Meanwhile, construction bids totaling $230,000 were to be opened this week.

•

New York Power Authority Attacks Chamber Proposal

The Power Authority of the state of New York, in a special interim report to the Governor and the Legislature, this week attacked the recent proposal of the state Chamber of Commerce that the authority be abolished through repeal of the 1931 act which set it up.

In the report the authority claimed that "the private power interests, which have persistently thwarted the Power Authority's efforts to advance the state's St. Lawrence power project, are, for the first time since 1931, openly renewing their attempt to prepare the way for private exploitation of the state's water-power resources."

•

Plans New Unit for Norwich

Specifications are now going out for an additional boiler and steam turbine unit, with auxiliaries, to be installed this year in the generating station of the Norwich, Conn., municipal lighting department. The boiler is to have a generating capacity of approximately 100,000 lb. of steam per hour at 900 lb. pressure and 750 deg. temperature, and the turbine unit will be rated at about 10,000 kva., designed to run at 3,600 r.p.m. and to deliver energy at 4,600 volts, three-phase generation. Arthur L. Nelson Engineers, Boston, Mass., are consultants.

•

Edward B. Lee Dies at Sea

Edward B. Lee, vice-president and a director of National Power & Light Co., died, of a stroke, early last Tuesday morning aboard the United Fruit liner *Castilla* on the way to New York from Guatemala, where he had been on a vacation. Mr. Lee, who was 61, had been with the Electric Bond & Share system since 1911.

Meetings

Public Utilities Advertising Association — Western regional conference, Hotel Muehlebach, Kansas City, Mo., January 31. Ray T. Ratliff, Kansas City Gas Co., Kansas City, Mo.

National Electrical Manufacturers Association — Mid-Winter conference, Waldorf-Astoria Hotel, New York, February 6–10. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

Edison Electric Institute—Prime movers committee, William Penn Hotel, Pittsburgh, Pa., February 6–7; electrical equipment committee, Statler Hotel, Buffalo, N. Y., February 6–7; transmission and distribution committee, Sagamore Hotel, Rochester, N. Y., February 9–10. Bernard F. Weadock, managing director, 420 Lexington Ave., New York, N. Y.

American Institute of Mining and Metallurgical Engineers—Annual meeting, New York, N. Y., February 13–16. A. H. Parsons, secretary, 29 West 39th St., New York, N. Y.

Louisiana Engineering Society — Annual meeting, St. Charles Hotel, New Orleans, La., February 23–25. A. M. Hill, secretary-treasurer, St. Charles Hotel.

Oklahoma Utilities Association — Annual convention, Tulsa, Okla., March 20–21. Kate A. Niblack, secretary, 625–626 Biltmore Hotel, Oklahoma City, Okla.

Association of Iron and Steel Engineers —Spring conference, Tutwiler Hotel, Birmingham, Ala., March 27–28. Brent Wiley, managing director, Empire Building, Pittsburgh, Pa.

Southeastern Electric Exchange — Annual conference, Ponce de Leon Hotel, St. Augustine, Fla., March 30–April 1. J. W. Talley, executive secretary, 308 Haas-Howell Bldg., Atlanta, Ga.

Missouri Association of Public Utilities—Annual convention, Muehlebach Hotel, Kansas City, Mo., April 12–14. Jesse Blythe, assistant secretary, Merchants Bank Bldg., 101 West High St., Jefferson City, Mo.

Electrochemical Society—Spring convention, Columbus, Ohio, April 26–29. Dr. Colin G. Fink, secretary, Columbia University, N. Y.

Commercial Group Plans Meet in March

The commercial departments of the utilities and manufacturers and jobbers of electrical appliances in the Northwest states will meet with the Business Development Section of the Northwest Electric Light and Power Association at the Multnomah Hotel, Portland, Ore., March 16-18. W. A. Huckins, Utah Power & Light Co., Salt Lake City, is section chairman. Arrangements are being completed by a local committee headed by George H. Wisting, Northwestern Electric Co., Portland.

The conference will be divided between general sessions on Thursday morning, Friday afternoon and Saturday morning and committee conferences on Thursday afternoon and Friday morning. Among the speakers at the general sessions will be Franklin T. Griffith, president Portland General Electric Co.; LeRoy A. Grettum, manager Eastern Oregon Light & Power Co.; Adam S. Bennion, Utah Power & Light Co., and C. A. Eastman, Ebasco Services, Inc., New York.

Conferences will be held by the commercial and industrial sales bureau under C. T. Bakeman, Puget Sound Power & Light Co., chairman; home modernization committee, J. F. McAllister, Utah Power & Light Co., chairman; home service committee, Ralph E. Gale, Idaho Power Co., chairman; advertising committee, Gilbert L. Stanton, Idaho Power Co., chairman. The rural sales bureau, Earl A. Olson, Idaho Power Co., chairman, will report on material developed at the Rural Electrification Conference held in Portland January 25-27.

•

Postpones Dam Hearing

Hearing scheduled for January 19 upon the proposal of the Copper District Power Co. to construct a diversion dam on the Middle Branch of the Ontonagon River in Michigan has been postponed by the FPC to February 2. The postponement was made at the request of the Attorney-General of Michigan on behalf of the Conservation Commission of the state, intervener in the proceeding.

•

Compiles Rate Schedules

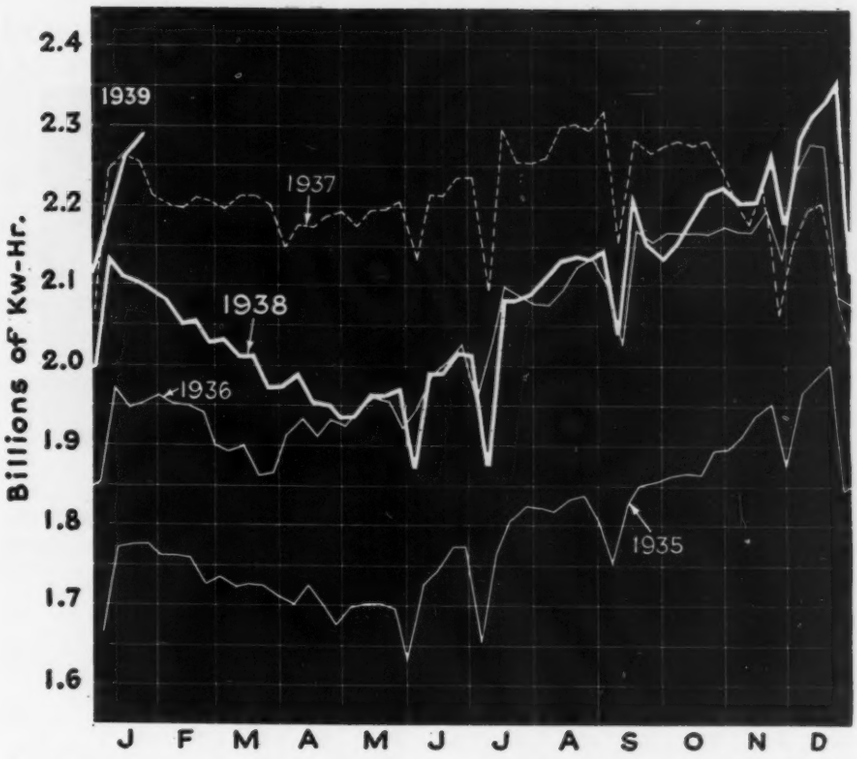
North Central Electric Association has issued rate books, showing complete electric rate schedules for North Dakota and for South Dakota. They contain the rate schedules for all municipalities in the two states, whether served by private companies, municipal plants or REA co-operatives.

Output Continues Rise; 9% Above '38

Continuing its advance, the production of electricity by the electric light and power industry for the week ended January 21 was 2,289,659,000 kw.-hr., a gain of 8.6 per cent over the corresponding week of 1938, according to the Edison Electric Institute.

This was also an increase of nearly 1 per cent over the previous week, in contrast with decreases for similar periods of earlier years.

New England, with a gain of 12.7 per cent, again led the major geographic regions in percentage increases over 1938; last week New England's gain was 12.8 per cent. The Central Industrial region, with a gain of 11.4 per cent over 1938 (previous week 9.4), was second. It is interesting to note, in this connection, that the Detroit Edison Company reported an increase over 1938 of 24 per cent in its output for the week ended January 21 and an increase of 52 per cent in industrial consumption.



Weekly Output, Millions Kw.-Hr.

1939	1938	1937
Jan. 21..2,290	Jan. 22..2,109	Jan. 23..2,257
Jan. 14..2,270	Jan. 15..2,115	Jan. 16..2,264
Jan. 7..2,169	Jan. 8..2,140	Jan. 9..2,244
	Jan. 1..1,998	Jan. 2..2,069
1938		
Dec. 31..2,121	1937	1936
Dec. 24..2,363	Dec. 25..2,085	Dec. 26..2,081
Dec. 17..2,333	Dec. 18..2,202	Dec. 19..2,275

Per Cent Change from Previous Year

Region	Week Ending Jan. 21	Jan. 14	Jan. 7
New England	+12.7	+12.8	
Middle Atlantic	+ 7.2	+ 6.1	Data
Central Industrial	+11.4	+ 9.4	not
West Central	+ 1.2	+ 0.6	com-
Southern States	+ 6.3	+ 5.5	par-
Rocky Mountain	+ 4.8	+ 3.1	able
Pacific	+ 7.6	+ 5.6	
United States	+ 8.6	+ 7.3	+1.4

Revive Proposal for Power Plant for New York City

The four-year old proposal of New York City's Mayor La Guardia for a municipal power plant was revived this week in the state Legislature in a bill sponsored by Representative Robert J. Crews.

The bill proposes that the city be authorized to set up a $50,000,000 plant, with a maximum capacity of 140,000 kw., which is about the capacity of the plant originally proposed, to serve a central area in midtown Manhattan. Federal loans to the power authority which would be set up are permitted in the proposal. Rates would be revised every three years to keep the authority "always self-supporting."

•

Auburn Acquires Properties

Western Public Service Co. has sold its properties in Auburn, Nemaha, Brownville, Rohrs, Howe and Graf, Neb., and 65 miles of rural transmission line to the city of Auburn for $342,000. Delivery of a warrant for that amount by the city to the private power company brought to a close a long legal battle by the city to acquire its own municipal light plant. The city came into ownership of the company's electrical property and generating plant and all its rural lines and distribution systems in Nemaha County.

•

Will Spend $16,000,000

Consumers Power Co. will spend approximately $16,000,000 this year in new plant construction and for other facilities. Dan E. Karn, vice-president and general manager, stated that "the outlook has improved sufficiently that we feel justified in expanding the original program which was interrupted by the 1938 recession."

•

Utility to Spend $1,202,000

Washington Water Power Co., Spokane, has budgeted $1,202,000 for capital outlay and construction work this year, according to J. E. Royer, general manager. The expenditures for new generating, transmission and distribution equipment will be about the same as last year. Hydro-electric plans include $131,000 to be used for installing new equipment in the company's present plant.

Washington State Utilities Pay $10,662,033 in Taxes

An analysis of the utility taxes in the state of Washington shows that the electric power group pays 27.5 per cent of the $10,662,033 paid, representing 95 per cent of all private utility taxes in the state.

The analysis prepared by the Northwest Electric Light & Power Association, and compiled by Berkeley Snow, executive secretary, tabulates by counties and by kinds the taxes of seven utility groups. It shows that five counties receive approximately one-half of all their property taxes from the utilities operating within their borders. The electric power group in the state pays approximately 5 per cent of the total property tax in the state.

•

Ross to Appraise Utilities

The Grays Harbor (Wash.) public power commissioners have engaged J. D. Ross, Bonneville administrator, and his engineers to appraise the properties of the Grays Harbor Railway & Light Co. and other private utilities in Grays Harbor County, with a view toward eventual purchase.

Utility Stocks Off in Week; Bonds Hold Level

50 Bonds
PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
36 Common Stocks
36 Common Stocks
50 Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1931 1932 1933 1934 1935 1936 1937 1938 Jan. Feb. Mar. Apr. May June 1939

A dip of 0.4 point sent the "Electrical World" index of electric power and light stocks to 29.6 this week; index for the corresponding week a year ago, 26.7. Bonds held their position in the week, with the "Electrical World" index holding at 103.9

Public Service Pays 60 Cents on Common

Directors of Public Service Corporation of New Jersey have declared the regular quarterly dividends on its common and preferred stock. Sixty cents a share was declared on the outstanding no-par value common stock payable March 31 to stockholders of record March 1. This is 5 cents a share more than was paid in the last quarter of 1938.

Also, $2 per share was declared on the 8 per cent cumulative preferred stock, $1.75 on the 7 per cent cumulative preferred stock and $1.25 on the no-par value $5 cumulative preferred stock, all payable March 15 to stockholders of record February 15. The regular monthly dividend of 50 cents a share was also declared on the 6 per cent cumulative preferred stock for March and April, payable March 15 to stockholders of record February 15, and April 15 to stockholders of record March 15.

•

Court Approved Expenditure of $9,000,000 for Claims

The federal court in Chicago has approved an expenditure of $9,000,000 by Utilities Power & Light Corp. for buying up small claims and debentures with a face value of $14,000,000. The corporation is under reorganization. The transaction has been approved by the SEC.

The court order provided that the $9,000,000 be spent only on debentures and claims whose owners ask for payment and are willing to accept 70 cents on the dollar. If the full $9,000,000 is not spent, the remainder will be used to buy at the same rate a portion of the $19,000,000 of debentures held by the Atlas Corp.

Funds for the payment will be taken from the Utilities Power & Light Corp., Ltd., of Canada, a subsidiary of Utilities Power & Light.

•

Forbids Debenture Issue

South Carolina Public Service Commission has refused to allow the Lexington Water Power Co. to issue $3,000,000 of 5 per cent debentures. The proposed issue "is not reasonably necessary and would not be in the public interest," the commission said.

•

Monongahela Cut in Par of Common Permitted

Reduction of the par value of Monongahela West Penn Public Service Co. common stock from $25 to $15 a share has been authorized by the SEC. The commission also authorized the issue and sale of 200,000 additional shares of its common stock at the $15 a share rate. Of these 200,000 shares 97,940 are now held by the Monongahela company in its treasury.

American Waterworks & Electric Co., Inc., was authorized to acquire the 200,000 shares at the reduced price, the $3,000,000 proceeds to be used by the subsidiary to discharge an open-account indebtedness of this amount to the parent unit.

•

Will Redeem Debentures

George N. Tidd, president of Appalachian Electric Power Co., has announced that $250,000 principal amount of sinking fund debentures, 4½ per cent series due 1948, will be redeemed on February 1 at 102 per cent and accrued interest.

Utility Bond Deal Approved by SEC

SEC has granted an application of the Pennsylvania Investing Corp., an indirect subsidiary of the Associated Gas & Electric Co., for approval of the sale of $1,477,900 of first and refunding 5 per cent mortgage bonds due in 1954 of the Kentucky-Tennessee Light & Power Co. to the issuer, also an indirect subsidiary of Associated, for $1,252,000, the cost of the bonds to the applicant.

The commission announced this week that Standard Power & Light Corp. has filed an application for exemption from the provisions of the holding company act in connection with the proposed investment of not in excess of $475,000 in 6 per cent notes or debentures, of varying maturities, of Standard Gas & Electric Co. at a price of not more than $65 and accrued interest.

The commission issued an order consenting to the withdrawal of the applications of Lexington Water Power Co. and Southeastern Investing Corp. in connection with the issuance by Lexington Water Power of $3,000,000 of 5 per cent serial debentures due 1939-1950 to Southeastern Investing Corp. in exchange for a like principal amount of 5½ per cent convertible sinking fund debentures due January 1, 1953.

•

Offers Shares Privately

Commonwealth Subsidiary Corp. has authorized Clark, Dodge & Co. to offer privately 298,538 shares of Commonwealth Edison Co. common stock owned by it at not less than $26 a share. Sales are to be made in blocks of 20,000 or more shares to a group of not more than fifteen individuals or corporations. The offering is part of Commonwealth Edison's program to liquidate Commonwealth Subsidiary for corporate simplification.

Utility Reports (Earnings)

	Net Income 1938	1937
†Detroit Edison and subs.	$7,833,306	$9,950,937
†Pub. Serv. of N. J. and subs.	22,733,245	24,531,606
*Duquesne Light	8,938,399	10,233,776
*Philadelphia Co. and subs.	6,230,842	8,829,110
*Louisville G. & E. (Del.) and subs.	1,220,535	1,365,450
*California Oregon Pwr.	893,227	972,249
*American Lt. & Trac. and subs.	4,813,042	5,697,766
*Continental G. & E. and subs.	3,903,695	4,598,115
*United Lt. & Pwr. and subs.	3,948,483	5,013,380
†Sierra Pacific Pwr.	686,085	549,301

†Twelve months ended December 31.
*Twelve months ended November 30.

Field OPERATING PRACTICES

New ideas and practices in the operation of well-designed constructed and maintained plants and systems

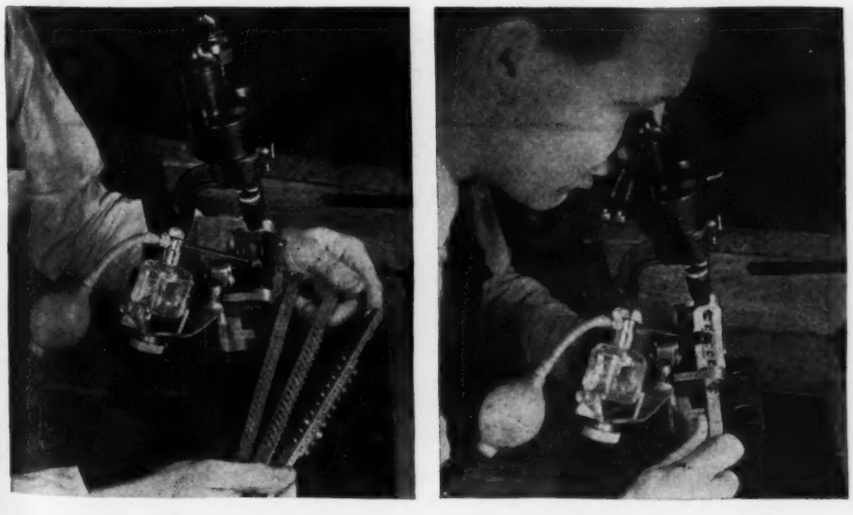
Meter Jewel Holder Speeds Inspection

Slow and tedious manual handling of meter jewels and pivots during miscroscopic inspection has been eliminated by an Eastern utility company with a special inspection rack developed in the meter department. With the rack (shown) it is possible to inspect an almost unlimited number of jewels with one adjustment of the microscope and to turn them at any angle desired while in the field of view of the microscope without touching them.

The apparatus consists essentially of a jig which fits into the bed of the microscope and into which any one of a series of bars holding from ten to twenty jewels of one size may be slipped. The jig allows the bar to be tilted laterally as well as turned on its axis to bring every point on the jewel sharply in view. Notches on the side of each bar allow successive jewels to be brought quickly into the field of view of the instrument. Attached to the jig is a clamp holding an atomizer for spraying carbon tetrachloride or other cleaning agents on dirty jewels.

A separate bar is required for each jewel or pivot size in use. Each bar is drilled with a series of holes or pockets large enough to take the jewel to be inspected. These holes are spaced far enough apart to allow but one jewel to be in the field of the microscope at a time. As many jewels can be held in each bar as the length of the bar will conveniently allow.

Axes of the jig about which the jewel holder bar is tilted or turned are so arranged that the surfaces of all jewels are exactly in focus at any and all angles at which the bar may be set. It is therefore not necessary to refocus the microscope after inspecting each jewel.



Jig allows rapid mass inspection of meter jewels

The bar can be turned on its two horizontal axes and indexed endwise to bring successive jewels into view.

Pull Three Cables From Single Reel

By A. W. FLIPPIN
Operating Foreman
Pacific Gas & Electric Company

Pulling three cables simultaneously in a single duct and from one reel was a procedure which saved considerable time in a recent Pacific Gas & Electric Company underground job. The installation consisted of three 12-kv. circuits, each composed of three single-conductor, 750,000-circ.-mil cables. Of those portions of the job installed in duct lines (part was direct-buried) part involved lead-covered cable, part rubber-covered cable.

Rubber-jacketed cable, with three conductors on single reel, ready for pulling

In both cases, where sections were not excessively long, the three cables for each section of a circuit were purchased on one reel. In ordering cable so reeled it is important to specify that all three cables be carried to the next layer on the same turn. If this is not the case, one turn of the reel when unreeling will release more of one of the cables than of

another, and this will produce unevenness, creating the hazard of jamming at the duct mouth.

Three lead-covered cables were successfully pulled into 4½-in. soapstone duct in sections up to 660 ft., tension averaging 3,400 lb. If duct lines and manholes were constructed with a view of facilitating pulling it is probable that 1,000-ft. sections could be run in this way without difficulty. Handling one reel instead of three has obvious advantages.

In the case of rubber-covered cables, which were pulled into 5-in. Transite conduit in 500 ft. maximum sections, tensions as high as 4,000 lb. were encountered when pulling was attempted with water lubrication. By lubricating with jelly prepared from high-grade soap chips these tensions were materially reduced and the job proceeded smoothly.

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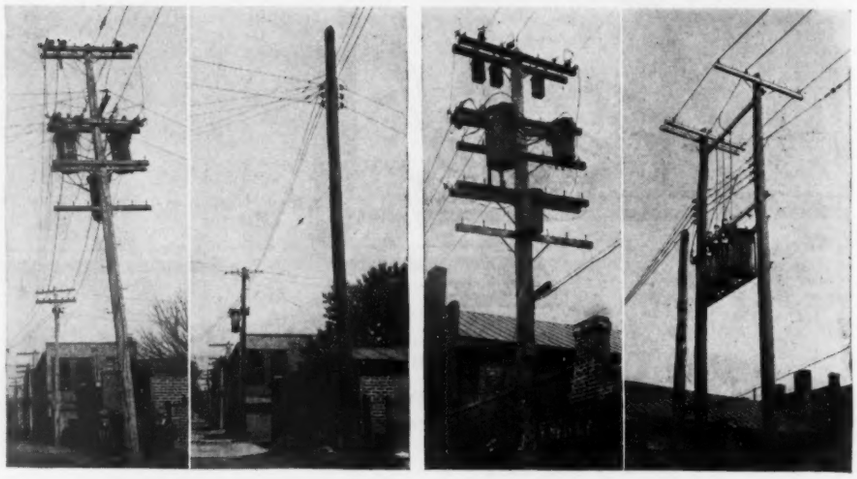
REBUILDING FOR APPEARANCE AND RELIABILITY



"Before and after" pictures show improved construction used in rebuilding overhead construction on system of Virginia Electric & Power Company.

Transmission Line Rebuilt at Night

By W. T. JOHNSON
District Superintendent of Operation,
Nevada-California Electric Corporation

Confronted with the problem of reinsulating and rebuilding a 50-mile portion of 88-kv. transmission loop during off-peak periods, engineers of the Nevada-California Electric Corporation worked out a schedule of night work that called for it to be done between 11 p.m. and 7 a.m. on weekdays and 8 a.m. and 5 p.m. on Sundays. During these hours the line could be taken out of service.

This schedule demanded lighting facilities. Portable lighting plants, one to each 55-ft. pole, offered an economical solution. These plants, rated at 300 watts, weighed 60 lb. and supplied pole-top lighting fixtures. Since the double gooseneck fixtures, shown, were slipped over the abandoned ridgepins to light the pole top, the only work that had to be done without light was the removal of the ridge wire and insulator (in advance of the lighting installation). Light from the fixtures was found so satisfactory that the original schedule calling for delivery of materials at the pole base by day was abandoned. A two-man assembly crew had been hired to uncrate insulators, assemble the steel arm and run a die over the threads. It was found that groundmen on the night crews had ample time and light to assemble material.

The fact that work was done on Sundays as well as at night afforded an excellent means of checking the cost of night work. It was found that a twelve-man crew and foreman could change sixteen poles per eight-hour day shift at night in comparison to 20 poles per eight-hour shift by day.

Transportation was difficult because the entire 50-mile section is in uninhabited desert where scarcely any roads are available. A camp was placed near the far end of the section and material and line crews were located there. Freight trucks were used to haul material to the end of good roads, and from there lighter trucks, capable of handling material for but eight poles, completed the distribution. Line trucks were left on the job and fast station wagons employed to save time in transporting men to and from work.

Portable 300-watt gas engine generators supply lighting fixtures for night line work

(a) Two-lamp fixture (right) slips over abandoned ridgepin to light pole top work while lamp on metal stake lights ground. B. O. Mitchell, construction director and designer of the equipment, stands by.

(b) Work on the 50-mile portion of 88-kv. line was started from both ends of the line and completed in 25 days with 40 men working nights, week days and daytime Sundays.

(c) Phones were connected by duplex to a line 1,000 ft. away for constant communication with the load dispatcher.

(d) Steel wishbone arms and suspension insulators replace pin insulators on wooden crossarms. This picture was taken on one of the four Sundays when work was done during the day.

Power Salesmen, please note. This new regulator is being announced in February and March issues of leading industrial magazines. You may perform a real service to your customers by bringing it to their attention.

A G-E "Regulator" to Give You Better Lighting— Better Motor Performance

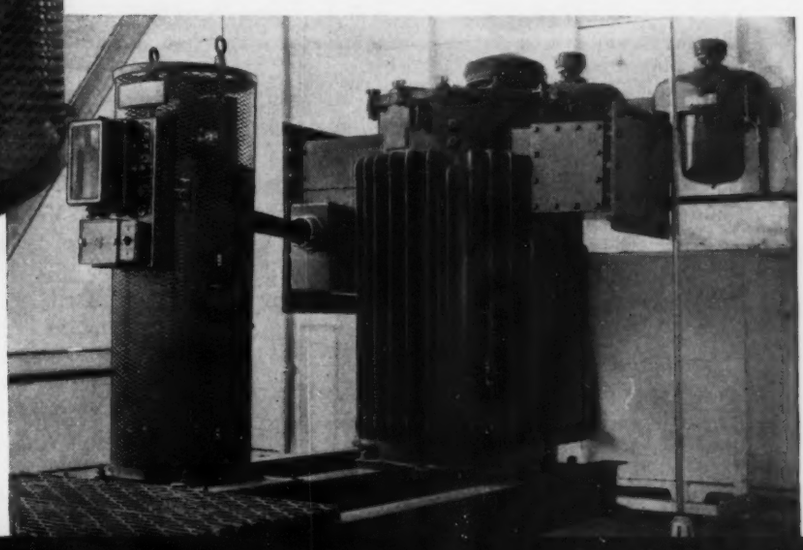
The new line of G-E air-cooled regulators includes regulators for automatic and for hand operation in single-phase ratings from 1.2 kva to 12 kva. For the regulation of lighting and power circuits, 10 per cent raise and 10 per cent lower are provided. The line also includes regulators with 100 per cent raise and 100 per cent lower—for testing purposes and for the control of voltage in industrial processes, such as those using resistance or induction furnaces

YOU know that voltage delivered at the correct level at your service entrance may fluctuate widely on your plant circuits because of varying power loads and lighting loads. You also know the advantages—in higher efficiency and increased production—of maintaining correct voltage on these circuits.

Now you can do it—economically—with the new G-E air-cooled induction regulators. They operate on the same principle as the larger units used by power companies. They give a smooth, precise voltage regulation that means better lighting, better motor performance, and better service from other electric equipment.

They are easily installed. Because they are air cooled, they require no expensive fireproof vaults. They take little space, and can be placed in out-of-the-way locations, even on beams up near the ceiling.

Find out for yourself how little these regulators cost. Ask your G-E representative for details, or write for Bulletin GEA-3057. Address General Electric, Dept. 6-201, Schenectady, N. Y.



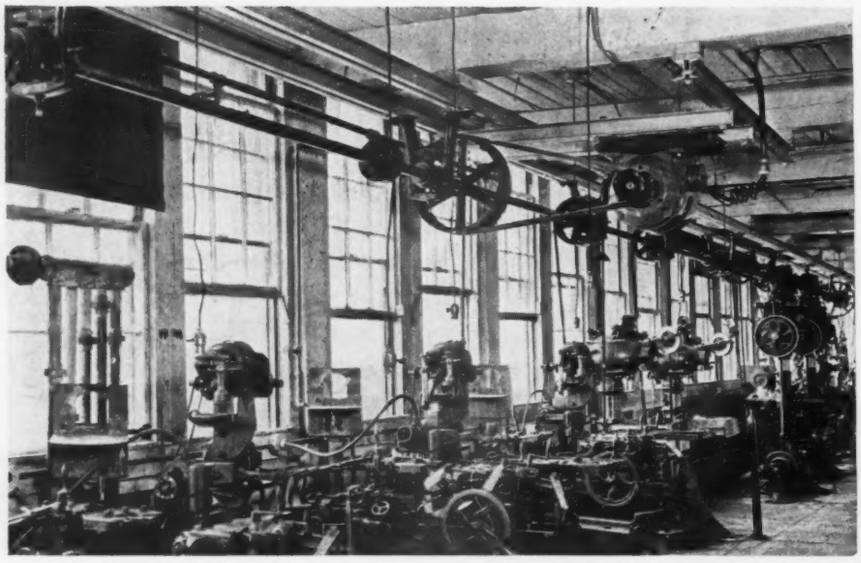
This automatic air-cooled regulator, installed next to a Pyranol transformer on an overhead platform, regulates a lighting circuit in a modern factory

GENERAL ELECTRIC

350-144

Industrial ELECTRIFICATION

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers



Combination Drive for Shoe Factory

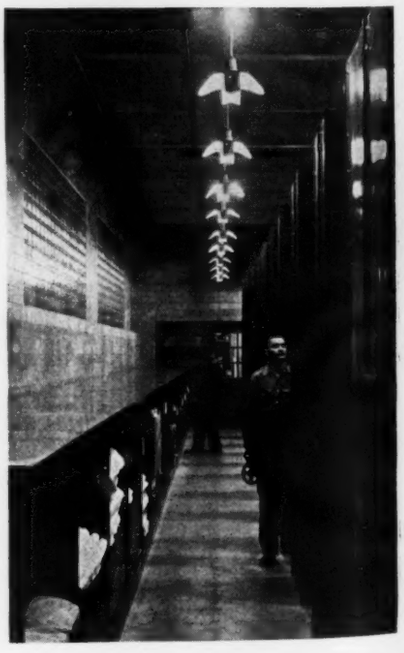
Judicious combination of individual and group drive in a proportion that yielded flexibility through grouping of essential production units and economy of motor horsepower has saved $7,420 in the first cost of remodeling the drive of the R. P. Hazzard Company, Augusta, Maine. Connected motor horsepower was reduced 24½ per cent, at the same time increasing production capacity, releasing aisle space and reducing overhead obstructions.

This plant, engaged in the manufacture of shoes, was formerly equipped with an old-fashioned line shaft drive system, using ring-oiling hanger bearings, sleeve bearing motors of many sizes and speeds and many belts. A total of 200 hp. in motors were used on the system. Many of the machines were inconveniently located, frequently encroaching unduly upon aisle space.

Two methods of increasing plant production by remodeling plant drive were analyzed—all individual drives and a combination of individual drives and engineered group drives. With individual drives, 213 motors having an aggregate rating of 190 hp. would have been required, with an estimated cost for motors and controls, exclusive of wiring and mechanical drives, of about $15,000. The combination of individual and group drive required 30 motors aggregating 151 hp. and representing a total cost of $7,580, including motors, controls, wiring, stripping the old line shafts, installing new steel stringers for hanger mounting, supplying bearings, etc.

The installation involved relocating various machines, in general placing important units closer to the walls than before, eliminating many of the former belts and arranging the 213 productive units of the plant in 25 groups, each group driven by a single motor. The remaining five of the 30 motors purchased were mounted directly on the individual machines. Each group drive motor was a ball bearing machine, having a no-load speed of 1,200 r.p.m. and ranging in size from 1½ to 10 hp. Shafts were driven through short center drives at 325 r.p.m. and are

BETTER BIN LIGHTING



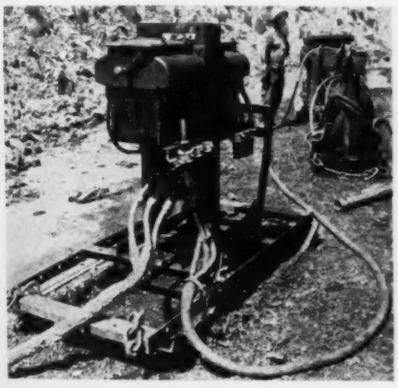
Modern bin lighting practice provides 8 ft.-candles on stored materials in the new $11,500,000 plant of the Industrial Rayon Corporation, Painesville, Ohio. Units are standard bin lighting units with 100-watt lamps mounted 8 in. above the stack and 5 ft. 6 in. apart. There are 92 of these units in this 14-acre, windowless, air-conditioned plant.

in anti-friction bearings supported by pressed steel hanger frames. Flexible hanger mounting is secured by placing 3-in. channels back to back with ¾-in. pipe spacers between to accommodate bolts.

•

Field Cable System Serves Strip Mines

Use of portable field cables together with skid-mounted junction boxes, oil switches and transformer banks to supply pit operations at three of the Indiana strip coal mines of the Maumee Collieries Company possesses a feature of service flexibility not common to most other strip mines in the state. Generally strip-



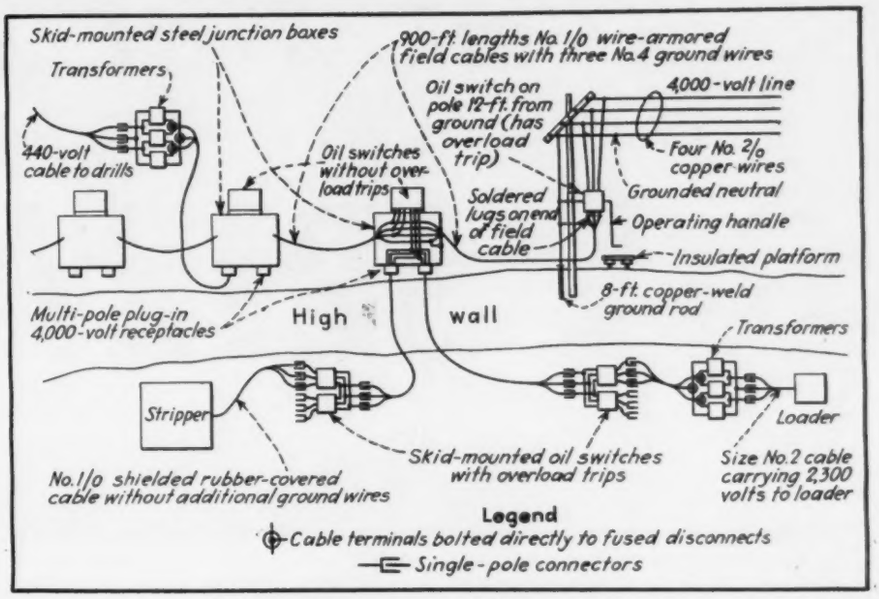
Pit breakers are skid mounted in pairs

Skid-mounted junction box and step-down transformers

ping operations are served over a pole line and laterals.

One mile of main cable in 900-ft. lengths, fed by a 4,000-volt pole line from the main substation, is the maximum at the Maumee operations. The method of supplying pit service over main and branch field cables is shown herewith.

Both trenchlay and spiral wire armored cables have been installed, but the former is preferred. In the case of the Chieftain No. 20 mine, shown diagramatically, the 900-ft. main field cables are No. 1/0 wire armored cables with three No. 4


Skid-mounted steel junction boxes
900-ft lengths No. 1/0 wire-armored field cables with three No. 4 ground wires
Transformers
Oil switch on pole 12-ft. from ground (has overload trip)
4,000-volt line
440-volt cable to drills
Oil switches without overload trips
Four No. 2/0 copper wires
Grounded neutral
Soldered lugs on end of field cable
Operating handle
Insulated platform
8-ft. copper-weld ground rod
Multi-pole plug-in 4,000-volt receptacles
High
wall
Transformers
Stripper
Loader
Skid-mounted oil switches with overload trips
Size No. 2 cable carrying 2,300 volts to loader
No. 1/0 shielded rubber-covered cable without additional ground wires
Legend
Cable terminals bolted directly to fused disconnects
Single-pole connectors

Field cable instead of pole line and laterals to serve strip coal mining operations *Coal Age*

ground wires and operating at 4,000 volts.

The 900-ft. lengths of main cable are joined by mine-made junction boxes equipped with two outlet plugs for laterals to serve pit equipment and are mounted on skids for easy transfer. Oil switches which control the feed to both the lateral outlet plugs are mounted on the skid with the junction box.

In other pits oil switches are usually back in the field and generally close to the end of the laterals. Maumee prefers these switches in the pits, where they can be reached easily in case of trouble. The switches are mounted two on a skid, as shown, and the 4,000-volt terminals, both incoming and outgoing, are single-pole connectors.

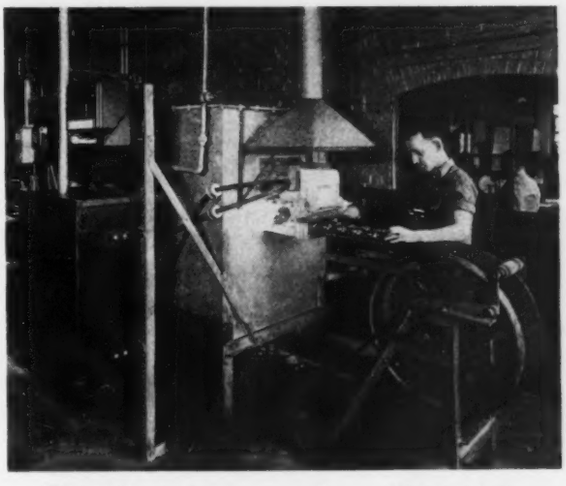
Where it is necessary to step down the 4,000 volts for use on low-voltage pit equipment transformers are banked on a skid together with their associated fused disconnects.

• • •

Electric Brazing Brings Benefits

For brazing typewriter and adding machine parts the Underwood Elliott Fisher Company, Hartford, Conn., recently installed a continuous, controlled-atmosphere electric furnace rated at 27½ kw. This change represented a shift from fuel-fired to electric brazing methods and has been marked by reduction of defects and sustained quality of production.

Material is run through the furnace on an 8-in. mesh-belt conveyor, through a 4½-ft. heating chamber to a 14-ft. cooling chamber beyond, at constant speed. Temperatures up to 2,100 deg. F. are required in forming the bonds between parts undergoing brazing, copper being applied at the joint either in the form of wire or paste. Cracked illuminating gas provides the furnace atmosphere.



Typewriter parts are continuously brazed in controlled-atmosphere electric furnace

What Men Like You

G-E SPIRAKORE

A New England utility executive states:
"Your wound-core construction is the biggest advance in distribution-transformer design that I have seen since I first started in the utility game twenty years ago. I would like to see this design in the larger sizes just as soon as you can possibly furnish it—say, in sizes 5 to 25 kva—and why stop there?"

A Southern utility engineer, in charge of maintenance and repair, states:
"It looks as if my job is going to be easier from now on. That wound-core transformer is so simple that there does not seem to be anything on it to go wrong. I do a lot of transformer designing in my line of work, and I can usually see things in a manufacturer's design that can be made better if done my way; but this is one time when you fellows have made a transformer which I can't think of any way to improve upon."

An Illinois utility purchasing agent states:
"This new wound-core design is the biggest contribution to the extension of rural electrification that has been made since our program for installing rural lines started. The lower cost has made possible the addition of several transformers in at least one locality where our budget figures indicated it would not be economical to supply service without the lower investment."

A New York State operating engineer said:
"I could stand here and watch that machine all day! It's fascinating! Every transformer leaving that machine is exactly like the last one. It is the last word in uniformity."

After seeing the core-winding operation, one customer remarked:
"I have seen the wound-core sample transformer your specialist had, and it looked so neat and compact I wondered why you had not built that design years before. The specialist told me that it was because no one had figured out a way previously to assemble the core and still retain minimum losses. I sat down later and figured out at least three ways of winding that core, but it wasn't until I had seen your method that I could see how the strains were entirely eliminated and the core iron used to its maximum efficiency."

A prominent efficiency engineer said:
"I have always been enthusiastic over the conservation of material as long as quality was not reduced. You have reached the optimum with the wound core where you have not only eliminated all scrap, but you are working every square centimeter of iron to its maximum efficiency. That is a wonderful engineering accomplishment."

One distribution engineer commented from another angle:
"The G.E. have already made friends with our linemen due to the reduction in physical size effected by the new wound-core design."

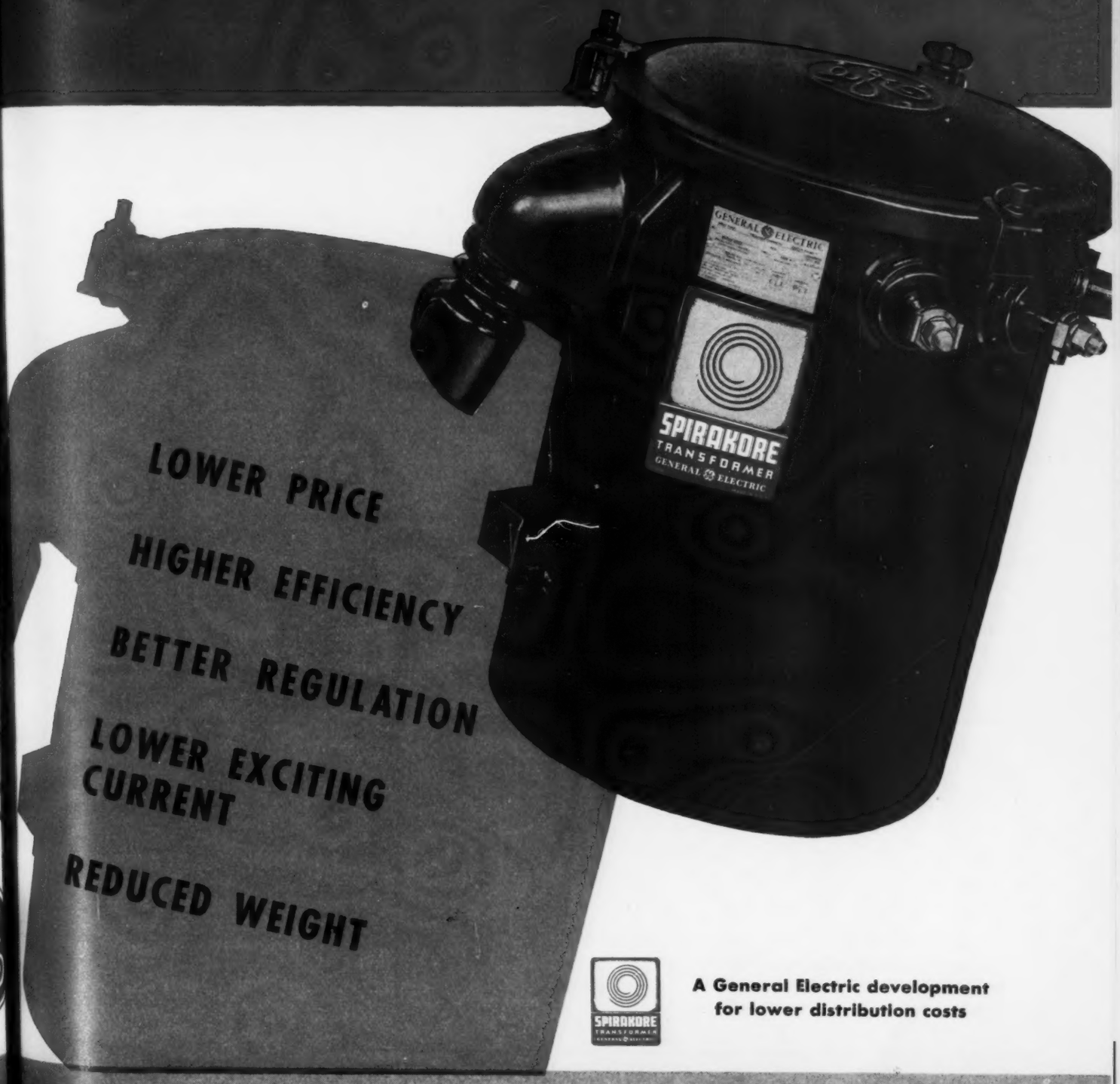
For additional facts about the SPIRAKORE transformer, ask your G-E representative for brochure GES-2038, which tells the story of the development of the wound-core design. For complete descriptive data, ask for Bulletin GEA-3085. General Electric, Schenectady, N. Y.

GE

G E N E R A L

are Saying About the

TRANSFORMER



LOWER PRICE

HIGHER EFFICIENCY

BETTER REGULATION

LOWER EXCITING CURRENT

REDUCED WEIGHT

SPIRAKORE TRANSFORMER

A General Electric development for lower distribution costs

ELECTRIC

300-76

New ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Slip-Frequency Relay Controls Motor Field

By FRANK H. MILLIKEN
Development Engineer,
Ideal Electric & Manufacturing Company,
Mansfield, Ohio

Accurate and reliable control of field excitation is necessary for best synchronous motor performance. Use of change in armature current, as the motor comes to speed on starting, has been recognized as a means of obtaining such control, but past attempts to develop a relay to operate on this characteristic have been complicated by the need for taking into account applied voltage. A new approach to the problem has been made by the Ideal Electric & Manufacturing Company with a slip-frequency relay for synchronous motor field control that depends for its operation on the magnitude and pulsations of armature current and the impressed voltage.

Shown schematically in the diagram, this relay consists of two elements, a current element and a voltage element, each consisting of a U-shaped laminated core and rotor on a common shaft. The two rotors have a fixed angular displacement so that when the coils are energized the two torques are opposed. A contact mechanism operated by a lever on the common shaft actuates a mercury tilt tube controlling the motor field excitation switch.

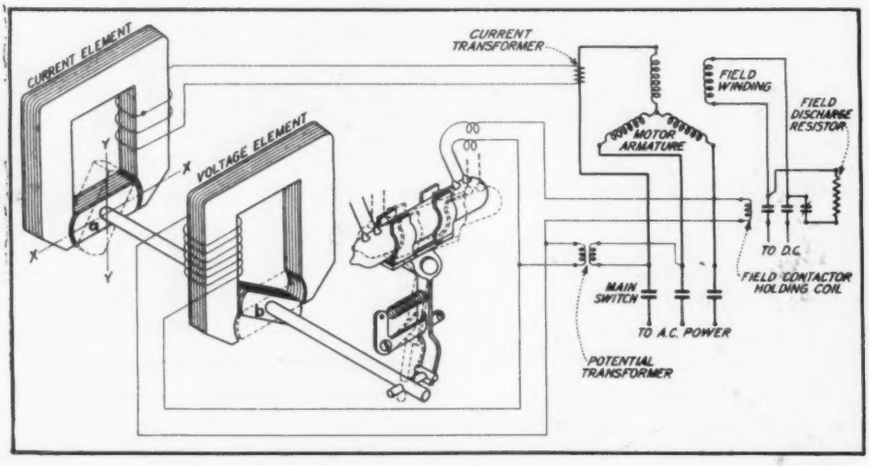
The relay is designed to close the field excitation switch of the synchronous motor at 95 per cent full load speed when the motor current is 136 per cent full-load current. Potential and current coils of the relay are designed so that the torques developed by the two armatures are practically equal at 95 per cent speed and also so that the natural frequency of the armature corresponds to the frequency of the armature current pulsations at 95 per cent speed.

Total movement of the relay armature is about 65 deg. When the armature is in the position of the solid lines in "a" no torque is developed. As the rotors move counter-clockwise from the position indicated by the solid lines torque increases, reaching a maximum in the dotted position. The dotted lines show the position of the rotors during normal operation with field applied. They will remain in this position when the motor is shut down, since there are no springs or weights on the relay shaft.

Starting, then, with the relay rotors in the position shown by the dotted lines, when the main switch is closed the current and potential elements of the relay will be energized simultaneously. Since the rotor is stationary heavy current will flow (about 250 per cent full load) in the relay's current element, exerting about 3½ times the torque exerted by the voltage element and turning the relay rotor to the position indicated by the solid lines and disconnecting the field excitation. As the motor approaches synchronous speed the current falls off, but little change occurs in the position of the rotor till speed reaches 95 per cent of full-load speed. At this point pulsations of armature current due to slip causes the relay armature to pulsate at its natural frequency. When the amplitude of the oscillations gets to the point where the potential armature "b" approaches its maximum torque region it is drawn into position (shown by the dotted lines) the latch of the tilt tube mechanism is tripped and the field excitation applied, and the motor pulls into step.

If because of momentary loss of voltage the motor drops out of step, when voltage is restored high current is drawn and the current element torque will overbalance the voltage torque and the relay trips off the field excitation contactor.

Under the action of low voltage, if the machine falls out of synchronism, the relay removes field excitation because of the drop in torque of the voltage element and the increase in the torque of the current element. Pull-out due to overload trips the



Slip-frequency relay provides field control for synchronous motors

DOING JOBS MORE NEATLY—AND AVOIDING TROUBLES

Using KEARNEY CLAMPS *and* SOLDERLESS WIRE CON-NEC-TITES

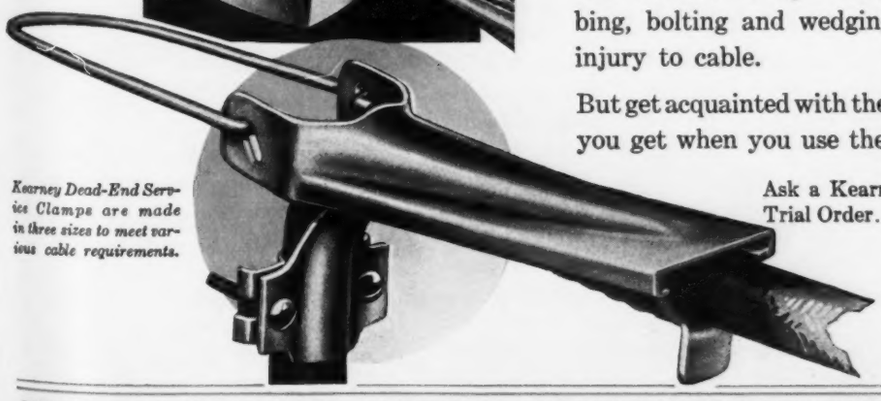
DEAD-ENDING or turning corners, securely, without risk of cutting or injuring cable, is easily and conveniently accomplished by using Kearney Economy Cable Clamps — specially designed to handle the job.

CONNECTIONS are neatly and positively made with Kearney Con-Nec-Tites which incorporate the use of a patented full round washer to give strength plus high conductivity.

POLE ATTACHMENTS or attachments at the house may be surely, conveniently and neatly made by Kearney Dead-End Service Clamps which combine the principles of snubbing, bolting and wedging to hold cable securely without injury to cable.

But get acquainted with the time and money-saving advantages you get when you use these and other Kearney accessories.

There are seventy-five Standard Kearney Con-Nec-Tites for making connections



Kearney Dead-End Service Clamps are made in three sizes to meet various cable requirements.

Ask a Kearney Representative about a Proof-Trial Order... Or write for Information—Direct

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JAMES R. KEARNEY CORPORATION

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ASK FOR LATEST PRICES OF ITEMS IN 300

relay by causing the current coil to draw current in excess of that at 95 per cent full-load speed, at which current and speed the relay is designed to operate.

•

Polariscope Detects Stress in Glassware

It is generally agreed that presence of internal stress in glass is closely related to the thermal and mechanical shock resistance of glassware. A tool that provides both the large user and the manufacturer of glassware with a means for determining the presence and estimating the severity of such internal stress has been introduced in the form of a new

New polariscope that is being used in detecting strains in the metal-to-glass seal of vacuum tubes and in lamps

polariscope by the Polaroid Corporation, Boston.

When homogeneous transparent materials, which ordinarily do not affect light passing through them, except by ordinary refraction, are subjected to external or internal stresses, the strained regions are characterized by certain changes in their optical properties. In consequence of these changes the strained regions behave optically in a way that might be called quasi-crystalline. When viewed between crossed polarizers they restore the light in a manner characteristic of the strains.

In the case of the Polaroid polariscope light from twelve 25-watt frosted lamps in a light box is polarized in one plane by passage through a sheet of polaroid, 10 in. in diameter. The subject being examined is held in the field of this plain polarized light and examined by the operator through a binocular eyepiece containing the "analyzer," a polaroid film with the optical axis at 90 deg. to the polarizer axis. The degree of strain as seen by the operator is indicated by the intensity and pattern of the white light or colors that appear in the specimen.

Applications of the device are said to be limited simply by the limitations of the polariscope technique. It is not good, for example, on opal glass. It works on any transparent glass in any thickness or size that can be got between the eyepiece and the light box. It may also be used on plastics where the presence or absence of stress may be a clue to the internal structure of the plastic mass.

A number of the polariscopes are in use in the electrical industry, all in lamp and radio tube factories. The polariscope technique has been found extremely useful in examining the glass seal (metal to glass) of vacuum tubes.

•

New Synthetic Resin Insulation for Wire

By E. J. FLYNN
General Engineering Laboratory,
General Electric Company,
Schenectady, N. Y.

A new and superior magnet wire, tougher and more flexible than the ordinary enameled types, has been developed by the General Electric Company. Known as "Formex" wire, it is insulated with a synthetic resin of the polyvinyl acetal type, rather than the drying-oil types which are in common use. Because of the toughness, flexibility, heat-, abrasion- and solvent-resistance of Formex wire, as well as its good electrical properties, it is expected to eliminate the need for space-consuming protective coverings in many instances.

Development of the new wire is the result of an intensive study of the properties required in an ideal magnet wire for use in electrical apparatus. Modern users of such apparatus are continually demanding lighter, more compact, more efficient, less costly and more durable products. One phase of the electrical designer's problem, in meeting these demands, is the provision of an improved conductor insulation. The advent of Formex wire means more copper, with less space needed for insulation and protection, and gives to the designer new opportunities to reduce the size of his product as well as to improve its characteristics in other respects.

Scope of enameled wire

Despite efforts to substitute enamel for other protective coatings, its use unprotected is still restricted to forms of apparatus for light service and where winding and assembly permits its application unimpaired. Protective coverings have still been necessary due to the physical and chemical limitation of the common types of enamel coatings.

Enameled wire has comparatively poor resistance to abrasion, proneness to softening by commonly used varnishes and solvents, and is subject to development of irreparable openings in the coating when the wire is heated under certain conditions. This last defect is most apparent at temperatures encountered during the baking of varnish impregnants and is sometimes referred to as "heat shock."

The properties enumerated below provide some qualitative comparisons of Formex wire with commercially available enameled wire. Formex wire is definitely superior to ordinary enameled magnet wire in the following respects:

1. Abrasion resistance.
2. "Heat shock" (resistance to cracking because of heating after elongation or bending).
3. Heat aging.
4. Flexibility.
5. Resistance to softening by common treating solvents.

The two types of wire are approximately alike in the following respects:

1. Dielectric strength.
2. Resistance to flow, or form stability (at 105 deg. C.).

Formex wire withstands the operations of winding, assembly and varnish impregnations markedly better than commercially obtainable enameled wire.

It can be used to advantage in practically all applications where enameled wire is used and can be used to replace enamel-cotton or enamel-paper covered wires in a great many instances where a protective wrapping was formerly necessary.

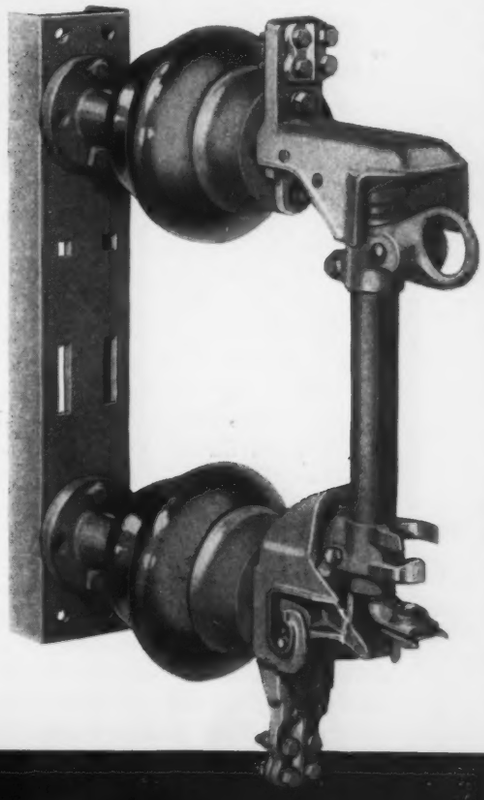
Limited quantities of the resin and present restricted manufacturing facilities have confined extensive commercial application of the new wire. These limitations are being corrected.

for your heavy load feeders

L-M 200 AMPERE CUTOUTS

TYPE PHA . . . Porcelain Housed 5000 Volts, 200 Amps. Door stays closed, protecting inside parts.

TYPE HAO . . . Open type Dropout Cutout . . . 7500 and 15000 Volts . . . 200 Amps.



With load up, and going higher, *adequate* fuse protection for heavily loaded feeders becomes increasingly important . . . lack of it increasingly risky! To insure adequate fuse protection in your heavy load areas Line Material Company offers two new 200 Ampere Cutouts . . . one a porcelain housed disconnecting cutout, the other an open type dropout cutout. These new L-M 200 Ampere Cutouts give dependable fuse protection at points where you need protection most.

Both Cutouts Give You These Features

- Built for cool operation at continued full rated capacity.
- Designed to extinguish the arc before contacts separate.
- Fuse Cartridges completely disconnected after fuse link blows.
- Clear indication of blown position.
- Rupturing Capacity meets N.E.M.A. standards.

LM LINE MATERIAL CO.

Building Up THE LOAD

New ideas and practices in selling electrical equipment and service to commercial and domestic customers

Electrical Circus Accelerates Business

By E. J. KIRKPATRICK
Commercial Manager
Indiana General Service Company,
Marion, Ind.

In the spring a small boy's fancy turns to thoughts of circuses if the small boy lives in the typical city or town of the Middle West. And it is not only the small boys that have such thoughts. So do the older inhabitants, and to them the appearance of circus bills on barns and fences is convincing assurance that winter is past and summer not far away. Therefore the idea of capitalizing on the general feeling, worked out by the electrical dealers and the utility at Marion, Ind., to hold an electrical circus was something only a little less than an inspiration.

At a meeting last April a group of fifteen dealers agreed to co-operate and the dates of the circus were fixed for three days in May. The promotion cost was estimated at around $500 and each dealer signed up for $35 as his share of the expense. As electric appliance advertising took a spurt, the newspapers in Marion and adjacent towns chimed in with much favorable publicity. For a week or so before the occasion a clown band toured the Marion trade area in a truck telling all and sundry about the big show.

A tent, 120 ft. long, 40 ft. wide, had been erected in the utility company's parking lot right in the center of town. Around the sawdust-covered center area, against the tent walls, were the dealers' booths, each 8 ft. deep and with frontage of 16 ft. The inside of the tent was garish with flags and streamers, generously interspersed with slogans on the uses of electricity. A loudspeaker system was installed for frequent announcements and for the entertainment, which consisted of talent locally well known and liked.

On the opening day came the grand parade, late in the afternoon so the school children might see it. Leading off were motorcycle policemen, followed by the mayor and chief of police. The 75-piece Marion high school band was next in line. Next came the dealers' floats, many of them elaborate and striking. Following was the Boy Scouts Mounted Patrol, and after them the clown band closing the procession with invitations to the public to come to the circus.

A large crowd, blocking the street, had gathered when the doors were opened at 7:30 that evening and the tent was soon full of people then and during the shows of the two following days. The Boy Scouts were given concessions at stands outside the tent to sell popcorn, peanuts, balloons and other circus day merchandise. Dealers made a number of sales during the show and each one secured the names of many prospects for future sales among the 6,000 or more people who visited the circus during its three-day stand.

•

Diverse Units Light New Service Building

By R. B. BROWN, JR.
Illuminating Engineer
Boston Edison Company

Whether the call comes by day or by night, the new service building and warehouse of the Westinghouse company in South Boston must be ready for immediate functioning. Adequate illumination for the finest workmanship is essential to these facilities, and intensities must be such as to permit speeding up operations to the maximum. The illumination problem in this establishment involved the provision of modern lighting for the associated offices as a matter of course, and it was specially interesting in the shop and ware-

Fig. 1—Combination mercury-Mazda units in side bays of shop, with Mazda single units in storehouse section at rear

Fig. 2—Alternate mercury and Mazda units light main shop area

house divisions because of the varied tasks imposed upon these areas, the desirability of utilizing daylight to the full, and of being able to expand the shop into much larger quarters should future business require.

Over all the new building is about 380 ft. long x 180 ft. wide. At the front a second story houses offices and a small auditorium, but in the main the structure is one story high with sawtooth roof construction on each side of a central area 50 ft. wide. The glass window panes if set in a single row 12 in. wide would make a strip 3.7 miles long, three-quarters of the wall area being of glass. This striking use of daylight made it desirable, therefore, to provide independent switch control of nearly all the individual lighting units in the shop and storehouse, by separate circuits run in conduit from "Nofuze" switch cabinets. The total connected lighting load is about 125 kw.

The general scheme of lighting the bays at the sides of the shop (Fig. 1) was to provide two combination mercury-Mazda units for each 20x30-ft. bay, locating them 15 ft. apart on the longer central axis and 7.5 ft. from the border of the bay. This gave a 15x20-ft. spacing for each group of four units, and the mounting height selected was 16 ft. Diffusing type reflectors were provided and the fixtures finished in Alzak aluminum. This gives about 40 ft.-candles on the working plane, all by general illumination, and using one 400-watt mercury and three 150-watt Mazdas per luminaire. This general spacing and mounting was continued along the side bays through the storehouse section, but in the latter 300-watt Mazda lamps in diffusing reflectors were initially installed, although the wiring permits using 850-watt combination units later.

The central shop section (Fig. 2) where heavier work is done, is characterized by a high bay, the lighting units being mounted 31 ft. above the floor and in three rows above a traveling crane covering the entire shop and storehouse middle area. Two types of lighting unit were used here, alternating these both laterally and longitudinally, with the result that the downward rays cross and mix far enough above the floor to provide a most satisfactory combination of color values approximating daylight. One unit is a 750-watt Mazda and the next a 400-watt mercury lamp through the shop section, the intensity being 30 ft.-candles on the working plane. In the warehouse center section 500-watt Mazda lamps are provided on the same spacings (20x16 ft. 8 in.) used in the shop area. Throughout, concentrating type reflectors were used, and the intensity in the central section of the warehouse is 15 ft.-candles.

Transformer capacitor units for the mercury lamps are mounted on the ceiling near the corresponding luminaire. In the warehouse center section the Mazda lamps are mounted in socket extensions wired for future 750-watt lamp service, thus providing for possible expansion of the manufacturing or work area into this section as required.

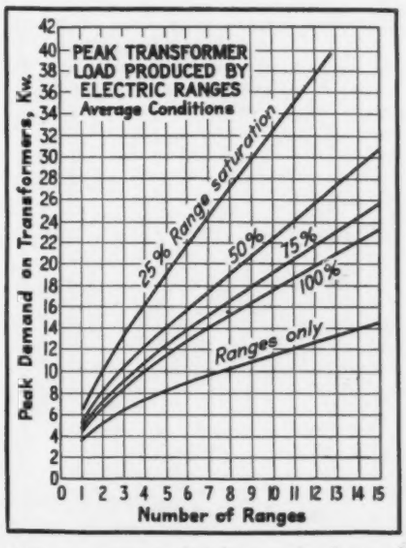
The approximate cost of the lighting installation for the shop and warehouse was $7,500, at current retail prices. The installation provides maximum flexibility of service, high economy of operation by utilizing natural light wherever feasible and controlling the use of artificial light at all points, while maintaining a reserve capacity which enables night work to be done as rapidly and accurately as daytime production.

•

Range Saturation vs. Range Demand

By A. G. PERGANDE
Distribution Engineer
Wisconsin Electric Power Company, Milwaukee*

More evidence that range load diversity factor increases with range load growth is shown by the accompanying graph, which is a byproduct of a recent study on water heater and range loads made by the Wisconsin Electric Power Company. The


PEAK TRANSFORMER LOAD PRODUCED BY ELECTRIC RANGES
Average Conditions
Peak Demand on Transformers, Kw.
Number of Ranges
25% Range saturation
50%
75%
100%
Ranges only
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42

More ranges make less unit demand on transformer capacity

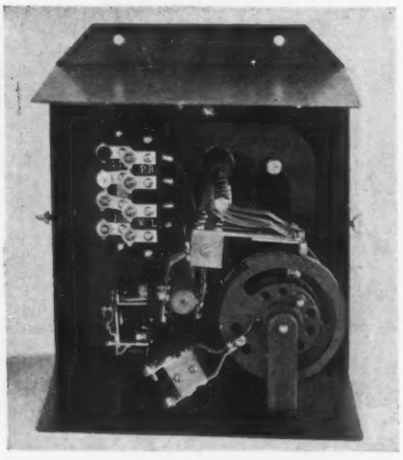
lower curve of ranges only indicates no change in diversity factors after the first seven or eight have been installed. But the widening areas between the curves of different saturations show clearly that in combination with other domestic loads the range diversity factor increases rapidly as more ranges are installed.

* Adapted from paper to Wisconsin Utilities Association.

New EQUIPMENT AVAILABLE

Welding Timer

A small constant-speed a.c. induction motor in this rotary welding timer drives cams which control both pressure to the electrodes and the weld cycle. These rotating cams have steps which are adjustable as to position. Each circuit uses two cams and the cam contacts are connected in series. The first roller drops off the cam step to make the circuit, while a short time later the second roller drops off its step to break the circuit, this process being repeated. This arrangement is said to provide a uniform and fast make and break and to make feasible the application of the timer to spot welding non-ferrous metals and thin stainless steel. For single-operation welding a non-repeat type is available. Timers are not intended to carry the actual welding load, being used with welding contactors.

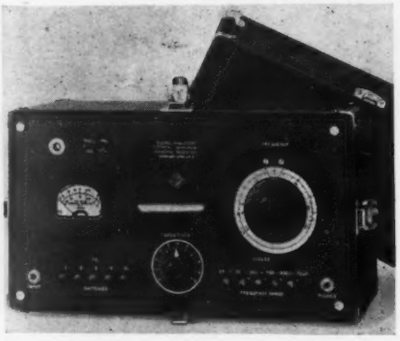


Variable-speed, repeat-type rotary welding timer; welding time variable from ½ to 12 cycles; welding speed, from 90 to 150 welds per minute. Timer contacts rated at 30 amp., 115 volts, a.c. **National Time & Signal Corp.**, Detroit, Mich.

●

Sound Analyzer

This sound analyzer was designed particularly for analyzing the noise and vibration generated by machines, motors, appliances and other mechanical and electrical equipment. Intended for use with the company's sound level meter, it may also be used with any microphone or vibration pick-up and amplifier combination which provides sufficient voltage output. It consists of a degenerative, selective amplifier and a logarithmic vacuum-tube voltmeter. Response frequency can be varied between 25 and 7,500 cycles by means of a rotary dial and the set of push-button switches.



Type "760-A" sound analyzer; usable output indications can be obtained with inputs ranging from 1 millivolt up to 10 volts; meter scale calibrated to read directly component tones down to 1 per cent of sound pressure of fundamental or loudest component. **General Radio Co.**, Cambridge, Mass.

●

Pilot-Wire Relay

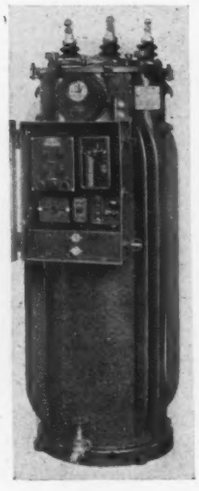
"HCB" pilot-wire relay. **Westinghouse Electric & Mfg. Co.**, East Pittsburgh, Pa.

Two pilot wires and no batteries are needed for this pilot-wire relaying equipment which has only a single moving element at each end of the section of line. Complete high-speed, one-cycle protection for phase and ground faults is said to be provided by the use of this single device. Relay can be applied to systems having a ratio of 10 to 1 between phase current and ground current. It can be used with pilot wires for a resistance of 2,000 ohms.

●

Induction Regulator

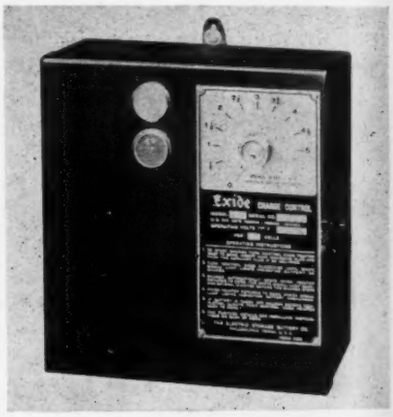
New induction voltage regulator is offered for both indoor and outdoor service. Control or supply connections, as well as interconnections between regulators, are not needed with this new design, it is said. Motor and control equipment is self-contained—to place the regulator in service, only three main connections need be made.



Station-type induction regulator; in ratings of 36, 48, 60 and 72 kva., single phase, 60 cycles, 2.4 and 4.8 kv. **General Electric Co.**, Schenectady, N. Y.

Battery Charging Control

Recharging of storage batteries used in electric industrial trucks is controlled automatically by this unit, designed for mounting on the charging panel. Use is made of the fact that cell voltage rises rapidly as the battery approaches full charge, the unit providing means for controlling the completion of the charge and later the cut-off. Housed in the case of the unit is an inverse temperature-compensated voltage relay, a synchronous motor-driven time switch, an auxiliary relay, two signal lamps and the necessary connection terminals.

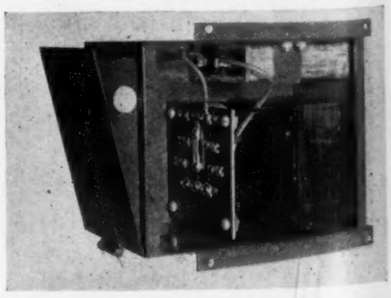


Charge control unit. **Electric Storage Battery Co.**, Philadelphia, Pa.

●

Motor Speed Controller

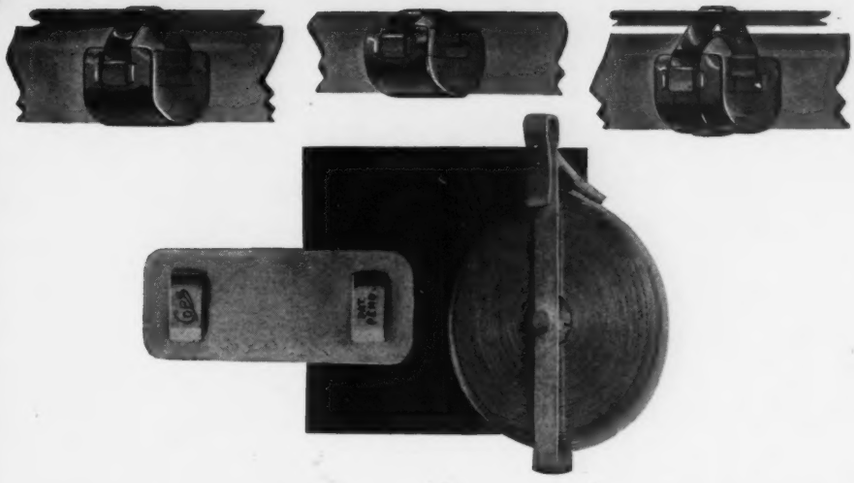
Multi-step speed controller for a.c. motors varies motor speed by changing the input voltage. Principal parts of the typical controller illustrated include an auto-transformer with voltage adjustment taps and an oil-filled condenser. This method of speed control is said to permit motor operation by a thermostat or automatic switch.



Speed controller for a.c. motors; built to specifications. **Raytheon Mfg. Co.**, Waltham, Mass.

"Cope"

TOOLS AND EQUIPMENT
FOR INSTALLATION OF
UNDERGROUND and OVERHEAD
ELECTRIC CABLES



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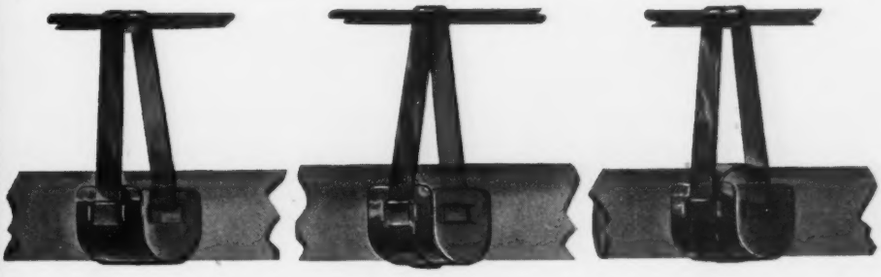
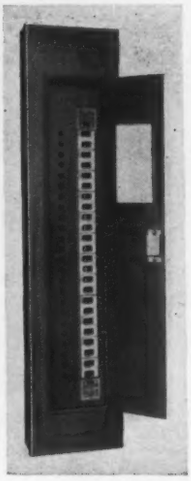


Industrial Lighting Panel

To meet special lighting panel requirements of the industrial field, this company has extended its "Multibreaker." The type shown is built to fit into the recesses of H-beams commonly used in plants.



Type "LX" panels; in two sizes for 8- or 10-in. beams; uses type "M" breakers; furnished in single- and double-pole branches up to 50 amp.; for either three- or four-wire a.c. service. **Square D Co.**, Detroit, Mich.

•

Pressure-Reducing Valves

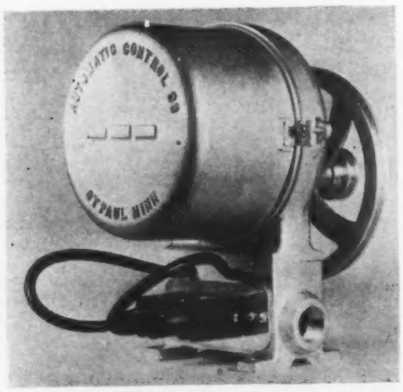
"Copes" pressure-reducing valves; eight models in line. **Northern Equipment Co.**, Erie, Pa.

New line of valves for steam and water pressure reducing service has been announced recently. Direct- and relay-operated types are offered for controlled pressures varying from a vacuum of 27 in. of mercury to 250 lb. Two relay-operated, spring-loaded valves are also available for use where remote control of the pressure reducing station is required; one of these is for use where the pressure drop across the reducing valve will be moderate, the other operates with pressure drops as high as 1,200 lb. Master controls used with these valves cover a controlled pressure limit of 2 to 600 lb. gage.

•

Float Switch

Inclosed contacts of the mercury-switch type are used in this multiple-circuit, single-float switch. Designed primarily to control the operation of one, two or three pumps, it may be adapted to control of valves, alarms, etc. Used as a pump control, it will cut in the pumps progressively as the demand requires and cut them out, in reverse order or all together, depending on the setting. By reversing the position of the mercury switches, the control may be used for pumping in or out of tanks.



Type "S" "Floatrol"; for float travel of 3, 6, 9 or 13 ft.; voltage ratings, 110 or 220 a.c. or d.c., 440 or 550 a.c.; switch capacity, 10 amp. **Automatic Control Co.**, St. Paul, Minn.

Electric Connector

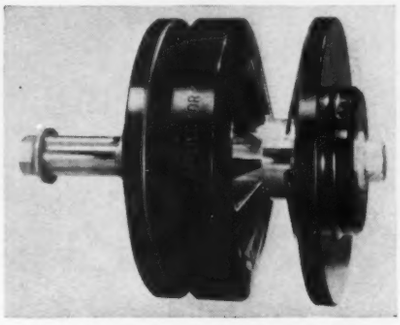
"Power Pick-Up," clips have 50-amp capacity, leads are No. 10 copper wires, rubber-covered. **Mueller Electric Co.**, Cleveland, Ohio.

Termed a "power-pick-up," a new adapter is offered for use in connecting any portable electric machine or floodlight to a source of current where it is impossible or inadvisable to connect it to an ordinary baseboard outlet. It consists of a length of flexible, rubber-covered cable, terminating in a connector at one end and in two clips at the other. Attachment plug on the portable machine is plugged into the connector and the terminal clips are snapped on to the busbars, fuse clips, switch blades or terminals of a distributing panel, for example.

•

Variable-Speed Pulley

A six-to-one up to a forty-to-one ratio of variable speed is a claimed advantage of this improved variable speed pulley. Pulley is interposed between motor and driven unit; its position can be shifted



"Speedmaster" variable speed pulley; in two sizes, 3½-in. diameter size for drives up to ½ hp., 6½-in. diameter size for drives to 3 hp. **Continental Machine Specialties**, Minneapolis, Minn.

so as to vary the center distances of the pulley with respect to the drive and driven sheaves. The belts thus assume smaller or larger operating pitch diameters. Control of speed is made through a lever or a handwheel allowing control within 1 r.p.m. Pulleys are made of Bakelite.

•

Industrial Controls

Room thermostats, oven controls and space thermostats; line rated at 25 amp. at 120 volts a.c. **Julien P. Friez & Sons**, Baltimore, Md.

Solid liquid charges, from which gases have been excluded, actuate the switch contacts of this new line of industrial controls so powerfully that high loads can be carried accurately and without relays, according to the manufacturer. This principle of operation is termed "hydraulic action." Types are offered for heating or cooling requirements of public buildings, offices, factories, storage vaults, ovens, unit heaters or coolers and other commercial and industrial applications.

•

Chromium-Plating Anode

"Lattice" lead anode for chromium-plating. **Securus Lead Products Co.**, 6410 Detroit Ave., Cleveland, Ohio.

Low electrical resistance, more even current distribution and mechanical rigidity against bending and warping are claimed features of a new type of lead anode for chromium plating and other electrolytic processes. On a lattice-type frame of strip copper is deposited and bonded a thin film of pure lead, a final treatment with a lead-burning flame being used to consolidate the coating.

•

Enclosed Fuses

"Silvend" fuses; 250 volts, ampere capacities from 3 to 600. **General Electric Co.**, Bridgeport, Conn.

A new line of non-renewable inclosed fuses with contact surfaces of heavily plated silver has been announced. They are said to be particularly applicable for use with control equipment, switchboards and other apparatus now made with silver-plated fuse contacts, as they protect against the hazard of inclosed fuses "heating due to oxidation."

•

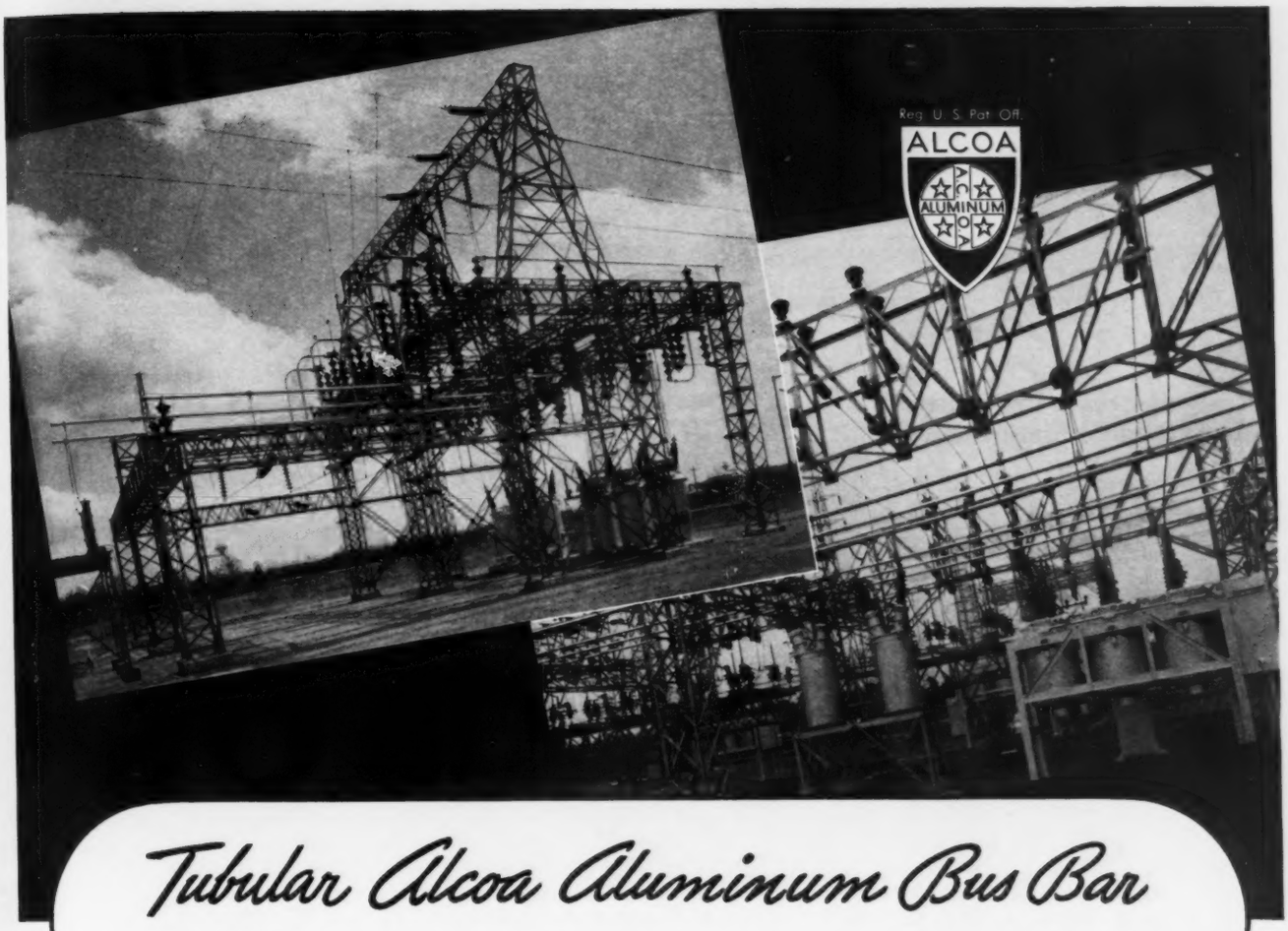
TECHNICAL BULLETINS

AIR CONDITIONING BOOKS AND CODES—So much literature has been published in recent years on air conditioning that the National Research Council, Ottawa, Canada, has prepared "A List of 63 Recent Books on Air Conditioning," with particulars as to their contents, publishers and prices. A second compilation entitled "Air Conditioning Codes" has also been made, as an aid to standardization of practices. Copies of each are available from the council at 25 cents apiece.

CREEP STRESS DATA—Creep stress data on the various "Croloys" and other materials supplied in tubular form by Babcock & Wilcox Tube Company, Beaver Falls, Pa., are available on a handy letter-size card to those interested in the design of tubular equipment for high-temperature, high-pressure service. Data were obtained, in nearly every case, by tests on commercial materials—creep tests averaging 3,000 hours duration.

WIRE AND CABLE DATA—Data on insulated cables, overhead conductors and other relative information are presented in the fourth edition of Henley's General Information booklet, published by W. T. Henley's Telegraph Works Company, Ltd., Holborn Viaduct, London, E.C. 1, England. This new and larger edition contains details of current ratings for cables laid direct in the ground suitable for voltages up to 30 kv., recently issued by the Electrical Research Association. Various tables of current ratings for rubber-insulated cables in accordance with the present edition of the I.E.E. Regulations for the Electrical Equipment of Buildings, and application of various formulae to determine cables sizes under practice conditions are other features.

RUBBER CONFERENCE—"Proceedings of the Rubber Technology Conference," which was recently held in London under the auspices of the Institution of the Rubber Industry, includes more than 100 papers on various phases of rubber technology from the physiology of latex-yielding plants to the marketing of manufactured articles. Cable manufacturers should find particularly interesting three papers devoted to the cable industry and to high-tension rubber cables. Publication price is £2 2s., or about $10.50; orders should be sent to the institution at 12 Whitehall, London, S.W. 1.



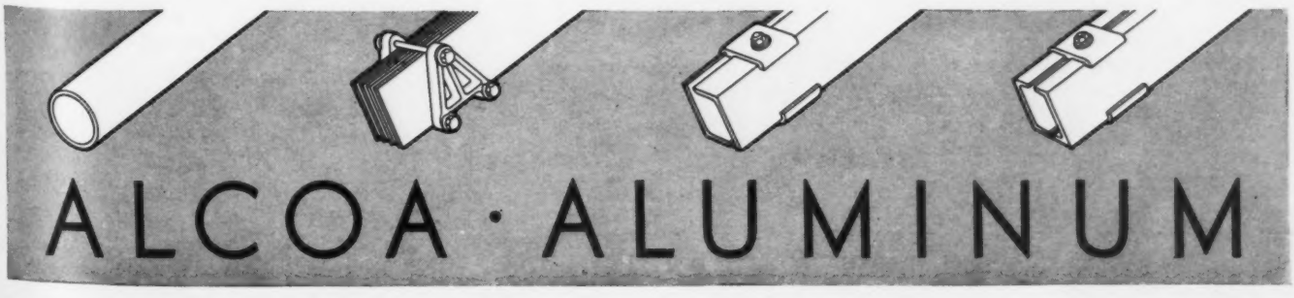
Tubular Alcoa Aluminum Bus Bar

SIMPLIFIES THE CONSTRUCTION OF OUTDOOR STATIONS

Light in weight, Aluminum bus bar places less burden on supports. They can be few and widely spaced, and the structure itself can be lighter in weight, thereby effecting many economies in materials and labor.

Standard construction methods and simple, inexpensive fittings are used with Alcoa Aluminum bus bar, whether tubular, flats, channels or angles. Installations are attractive. They stay that way, because Aluminum weathers well and stands up under corrosive conditions encountered in most manufacturing processes.

Alcoa Aluminum bus bar offers a high degree of thermal, electrical and mechanical efficiency. Ask our engineers to assist you in selecting the material which best meets your needs. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pennsylvania.



News ABOUT PEOPLE

C. C. Wales Made President of Iron & Steel Engineers

C. Clarke Wales, assistant general manager of the Algoma Steel Co., Ltd., Sault Ste. Marie, Canada, has been elected president of the Association of

Iron and Steel Engineers for the year 1939.

Following graduation from the University of Toronto, Mr. Wales joined the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. In 1925 he became associated with the Otis Steel Co., and four years later was made chief engineer, in which position he supervised the planning and construction of its 72-in. hot and cold strip mills. In 1937 he went with the Algoma Steel Co., taking the position of assistant general manager.

Other members of the board of directors are:

First vice-president, J. A. Clauss, chief engineer Great Lakes Steel Corp., Ecorse, Mich.; second vice-president, William A. Perry, electrical and power superintendent Inland Steel Co., Indiana Harbor, Ind.; secretary, J. L. Miller, assistant chief combustion engineer Republic Steel Corp., Cleveland, Ohio; treasurer, F. E. Flynn, manager Warren district, Republic Steel Corp., Cleveland, Ohio.

•

▶R. C. LANPHIER, president of the Sangamo Electric Co., was recently honored, on the occasion of the company's fortieth anniversary, with the gift of a valuable ring, commemorating the occasion. The employees of the factory, numbering more than 1,100, joined in voluntary contributions ranging from nickels and dimes to much larger sums to make the gift possible.

•

Changes in Wire Department Announced by U. S. Rubber

A number of important changes in the executive personnel of the wire department, United States Rubber Co., have been announced by C. W. Higbee, manager of wire sales.

M. P. Lewis, formerly eastern district manager, wire sales, has been appointed assistant manager wire sales department, with headquarters in New York. Mr. Lewis has been associated with U. S. Rubber since 1919. H. H. Weber, assistant manager wire sales department since 1934, has been appointed commercial engineer of that department. Previously he was in the engineering divisions of the Rome Wire Co. and the General Cable Corp. H. J. MacDonald, who has handled wire sales in the New England territory of the company for the past eighteen years, has been selected to succeed Mr. Lewis. He will continue his headquarters at the Boston office. Appointed to the position formerly held by Mr. MacDonald is C. W. Short, for the past two years development manager at the Bristol plant.

•

▶R. J. FRANK, vice-president Copperweld Steel Co., was made the recipient of an engraved plaque at a surprise dinner given by fifty of his associates on January 14, commemorating his twentieth year of service with the company.

▶ELDON E. BECK, for the past nine years superintendent of the Idaho Power Co.'s Swan Falls power plant, has been appointed the first full-time safety director of the company. He will work within the department of land, taxes and insurance under the direction of G. H. Petersen.

K. I. Jack of Utah Accepts New Position in Spokane

Kimball I. Jack has been appointed advertising and sales promotion manager of the Washington Water Power Co., Spokane, as a part of a program of sales expansion. This is a newly created position in the Washington Water Power service. Mr. Jack goes to Spokane from Salt Lake City, where he was assistant advertising manager of the Utah Power & Light Co.

"Mr. Jack will have complete charge of all sales promotion and advertising of the company," said Lewis A. Lewis, assistant general manager in charge of sales, "including the preparation of all promotional material, co-ordinating the programs of our residential and farm, commercial and industrial sales

departments, and serving as the conmeeting link with our advertising agency."

A graduate of the University of Utah, Mr. Jack attended the Art Institute of Chicago and was engaged in educational and newspaper work before being employed by the Utah Power & Light Co. in 1929. While in Salt Lake City Mr. Jack has been active in civic and community work.

Other appointments in the expansion program include division sales managers, as follows: Spokane, Frank A. Tool; Palouse, J. J. Fox; Lewiston,

SOUND PROTECTION *through*

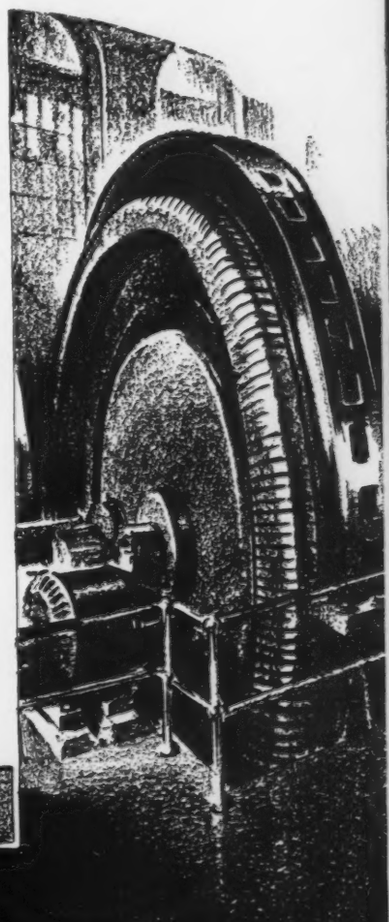
UNQUESTIONED FINANCIAL STRENGTH

● No risk is too great for "Ocean and Columbia" to assume for the protection of your boilers, turbines and power plant machinery. "Ocean and Columbia" policies are amply backed by present assets — by a long background of sound insurance methods — by a 60-year record of never having failed to pay a just claim.

Millions of dollars prudently invested in the highest type of liquid securities permit insuring the largest power units at their full value — with assurance of full protection from all types of accidents — ranging up to the most disastrous.

Your power plant equipment — from boilers to bus bars — is subjected to a highly-efficient accident-prevention inspection service by engineers who talk your language, who understand your engineering and operating conditions. By protecting your plant with an "Ocean and Columbia" policy, you can forget operating risks. They have been assumed by one of the strongest financial organizations in the world.

Send for further information — TODAY!



INDUSTRIAL and UTILITY POWER PLANT *insurers*

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COLUMBIA CASUALTY COMPANY

THE OCEAN ACCIDENT & GUARANTEE CORPORATION
COLUMBIA CASUALTY COMPANY
One Park Avenue, New York, N. Y.

Canadian Branch: The Ocean Accident & Guarantee Corp., Ltd., Federal Building, Toronto, Ontario
Cuban Correspondent: Compania Cubana de Fianzas, Amargura 23, Havana, Cuba

Gordon DeFoe; Cœur d'Alene, A. G. Mayer; Big Bend, Fred J. Williams, and Okanogan, E. W. Belknap.

•

▶ CLYDE V. HUSSEY has been appointed head of the customer and personnel relations development department recently organized by the Mississippi Power & Light Co. Mr. Hussey served five years as manager of the Knoxville division, Tennessee Public Service Co. Prior to that he was associated with the Florida Power & Light Co.

▶ WILLIAM L. R. EMMET, consulting engineer of the General Electric Co., was made the recipient of the David W. Taylor Medal by the Society of Naval Architects and Marine Engineers. Mr. Emmet is honorary vice-president of the society. The award cited Mr. Emmet's "notable achievements in the advance and development of marine machinery, the most outstanding of which was the electric drive."

•

O. W. Jones New President of Petroleum Power Club

O. W. Jones, who was elected president of the national Petroleum Electric Power Club at the recent convention in Tulsa, Okla., is industrial power supervisor for Central Power & Light Co., Corpus Christi, Tex. Mr. Jones is widely known to the South Texas oil fraternity through his connection with the utility company and with the

Petroleum Electric Power Club, which embraces all oil-producing states from the Great Lakes to the Gulf.

A native of Columbus, Ohio, Mr. Jones was educated at Ohio State University. In 1908 he joined the Columbus Railway, Power & Light Co. and was in the service of that organization until 1916, when he joined the Texas Power & Light Co. at Dallas in an engineering capacity. In 1926 he became associated with Central Power.

R. B. Childs Appointed Head of New Spokane Division

The plan of divisional management being introduced by the Washington Water Power Co. is gradually taking form. The first division to be created is Spokane and the first division man-

ager is R. B. Childs, formerly assistant general manager. To Mr. Childs has been assigned the task of co-ordinating under him all the direct customer contacts, sales activities, service, control of local distribution lines, steam heating and bus operation. The present heads of these departments will continue, reporting to Mr. Childs.

Other division heads will be appointed over the territory served by the company so that some one in each district will be directly responsible for operations in that district.

OBITUARY

Charles S. Ruffner

Charles S. Ruffner, electrical engineer and chairman of the board of directors of the Schenectady Trust Co., died in his sleep January 21 at Fort Myers, Fla. Mr. Ruffner, who was 58 years of age, had been in failing health for two years and went to Florida a week before his death.

Mr. Ruffner spent almost twenty-five years in the electric light and power industry. A native of Chicago and a graduate of the University of Missouri, he supervised construction of transmission lines for the Telluride Power Co. of Colorado and directed operations for the Central Colorado Power Co. When the construction of the Keokuk plant on the Mississippi River was proposed he was called in by the St. Louis companies as vice-president and general manager. Later he became vice-president of the Union Electric Light & Power Co. and in 1919 he was elected a vice-president of the North American Co., which controlled the Union Electric, relinquishing the local management in St. Louis to assume broader duties for the parent company. He was elected vice-president and general manager of Adirondack Power & Light Co. in 1921, president of Mohawk-Hudson Power Co. in 1925, president New York Power & Light Corp. in 1927, serving in the last named until 1929. He also had been vice-president of Niagara Hudson Power Co., retiring in 1931. Mr. Ruffner was a past-president of the Empire State Gas and Electric Association and a fellow of the American Institute of Electrical Engineers.

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Henry M. Atkinson

Henry M. Atkinson, chairman of the board of the Georgia Power Co. and for more than forty years a leader in the industrial progress of Georgia, died in Atlanta January 21, after a long illness. He was 76 years of age.

Mr. Atkinson devoted his abilities and fortune to public undertakings which contributed to the industrial and educational development of the community and his services in the electrical development field have been particularly valuable. He was the leader of the enterprise which resulted in Atlanta's having its first electric lighting system in 1891. He was the first president of the Georgia Electric Light Co. and was an important factor in the consolidation of the City Railways & Lighting Cos. of Atlanta into the Georgia Railway & Electric Co. In recognition of his services to the company Georgia Power named its plant on the Chattahoochee River the Atkinson steam plant.

A native of Brookline, Mass., and a graduate of Harvard University, Mr. Atkinson was engaged in the cotton business in Atlanta, later entering the banking field, serving as an executive of a number of institutions before he began his work in the utility field.

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▶ BENJAMIN F. BOYNTON, 83, advisory claim agent of the Portland General Electric Co., Portland, Ore., and widely known for his years of activity in civic affairs, died December 17 at his home in that city. He was a leader in one of the earliest movements for public safety in Portland.

▶ RUSSELL HARGRAVE, a member of the advertising department of the Georgia Power Co., and editor of *Snap Shots*, published by Georgia Power, died December 15, in his twenty-sixth year, at the home of his parents in Thomasville. He had been in ill health for several months.

Manufacturing AND MARKETS

$250,000 New Orders for Crocker-Wheeler

Crocker-Wheeler Electric Manufacturing Co. has recently booked new business in excess of $250,000, according to Edmund Lang, president. New orders include several jobs for the United States Navy and 30 large motors for a flood control project in Pennsylvania. Contracts also have been made with numerous municipalities.

Mr. Lang said he foresaw a definite improvement in electrical machinery business in 1939. The company's new electrical appliance division plans to introduce several new products this year.

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Porcelain Insulator Gains Shown in Census Report

Porcelain electrical supplies manufactured in 1937 had a total value of $24,836,731, compared with $12,751,034 in 1935, according to the recent biennial Census of Manufactures.

Insulators accounted for $7,537,176 of this total, as against $3,708,315 in 1935. This was divided nearly equally between pin type, which totaled $3,110,260 as against $1,548,930 in 1935, and suspension insulators, which amounted to $3,329,023 as against $910,131 in 1935. Knots, tubes and cleats, making up the rest of the insulator total, decreased to $1,097,893 in 1937 from $1,249,254 in 1935.

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Washers in Use Totaled 13,500,000 in January

Beginning his second term as president of the American Washer and Ironer Manufacturers' Association, W. Neal Gallagher, head of the Automatic Washer Co., Newton, Iowa, announced that the total of household washers in use in this country passed 13,500,000 in January.

More than 125 industry executives at the association's annual meeting in Chicago formulated plans for extension of co-operative research and promotion efforts. In deference to the memory of William H. Voss, late president of Voss Brothers Manufacturing Co., Davenport, Iowa, dean of the industry, association treasurer since its founding in 1916, who died last week, no successor was named. The duties of the office were merged with those of executive secretary, Joseph R. Bohnen, Chicago.

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TVA Lets Contracts to General Electric

General Electric Co. has received a TVA contract to supply transformers, regulator and neutral grounding reactors for a primary substation at Columbia, Tenn., at cost of $229,560. General Electric Co. also received a TVA contract to provide oil circuit breakers for a primary substation at Decatur, Ala., involving $40,999.

Other supply contracts recently awarded by federal agencies include:

Sterling Engine Co., TVA, generator unit, $13,217.

National Carbon Co., TVA, carbon electrodes, etc., $17,662.

General Electric Co., Department of Interior, oil circuit breaker, $18,700.

Moloney Electric Co., TVA, outdoor transformers for primary substation at Decatur, Ala., $64,000.

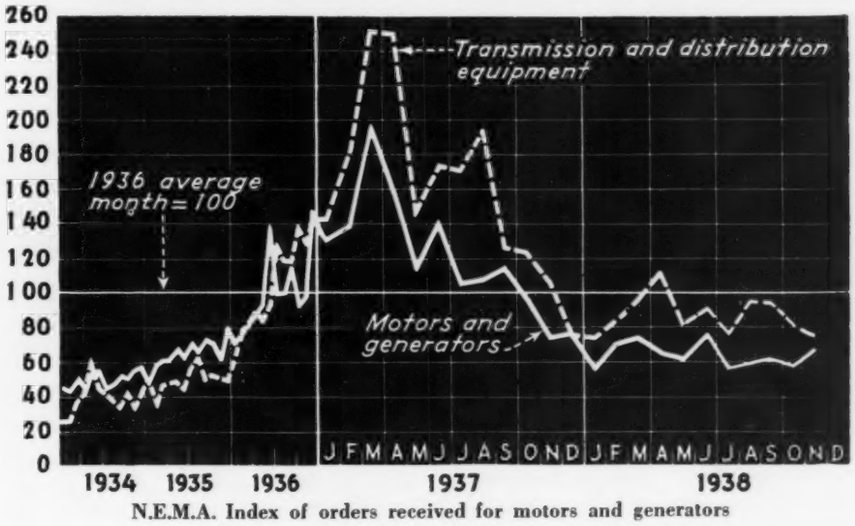
Equipment Orders Gain in November

In sharp contrast to the correspond ing period of 1937, value of orders for generators and motors during November rose 10.8 per cent over the previous month, according to the N.E.M.A. index, which gained 6.6 points to 67.6. The percentage change for November over October during the preceding four years has been, beginning with 1934, +10.2, —11.6, +5.2 and —25.1.

In this group are included a.c. generators (except waterwheel and turbogenerators), a.c. and d.c. motors, from 1-200 hp., and synchronous motors, 1 hp. and larger.

The index for transmission and distribution equipment dropped during November 4.1 per cent, or 3.3 points, to 77.1. However, this decrease was less than expected on a seasonal basis and compares with successive decreases, beginning with 1934, of 18.9, 6.5, 6.0 and 13.4 per cent.

	Motors and Generators		Transmission and Distribution	
Month	1938	1937	1938	1937
June	76.0	140.4	89.3	172.8
July	59.1	105.6	76.9	170.4
August	60.2	107.5	95.7	193.4
September	62.7	113.4	91.7	125.2
October	61.0	97.4	80.4	122.7
November	67.6	73.0	77.1	106.3



N.E.M.A. Index of orders received for motors and generators and for transmission and distribution equipment

Manufacturers Make Sales Assignment

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

Triangle Conduit & Cable Co., Inc., has announced that Andrew C. Tomb of Mansfield, Ohio, has joined the sales organization. He will operate in the states of Ohio and West Virginia and will be under the direction of D. W. Droll, Droll Electrical Sales Co., Detroit, exclusive agent in Michigan, Ohio, West Virginia and Kentucky, east of Frankfort, for the Triangle Co.

W. A. Hesse & Co., Alameda, Calif., has announced the appointment of Hawaiian Electric Co. of Honolulu as its representative in the island territory.

Proctor Electric Co. has named E. H. Grant as representative in the New England states and T. P. James will cover the state of Michigan with headquarters in Detroit.

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Manufacturers' Sales Gain

Manufacturers' sales of electrical machinery, apparatus and supplies during November, as reported by 107 firms, totaled $25,706,000, as against $25,516,000 in October and $26,815,000 in November, 1937, according to the Department of Commerce.

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Concentrates Activities

The Roller-Smith Co. announced the consolidation, as of February 1, of its executive offices (located prior to February 1 in New York City) with its works at Bethlehem, Pa. After that date all activities of the company will be concentrated at the new headquarters at Bethlehem. The district sales agencies in New York City and in all principal cities in the United States and Canada are not affected.

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Reduces Toaster Prices

Proctor Electric Co. of Philadelphia has announced that new production methods have enabled it to reduce the 1939 prices of its line of toasters 25 per cent to 43 per cent under the 1938 prices.

New York Metal Prices

	Jan. 24, 1939 Cents per Pound	Jan. 18, 1939 Cents per Pound
Copper electrolytic	11.25*	11.25*
Lead Am. S. & R. price	4.85	4.85
Antimony	11.75	11.75
Nickel ingot	35.00	35.00
Zinc spot	4.89	4.89
Tin straits	46.125	46.50
Aluminum, 99 per cent	20.00	20.00

* Delivered Connecticut Valley

Field Reports on Business

The present hesitancy in business activity is being closely watched for indications of future trends. The slowing down had been anticipated to some extent following the expansion which took place last fall. Orders for immediate requirements continue the rule. Reports indicate that inventories are still low.

CHICAGO

Business activity in general was fairly steady last week, although the forward movement showed a tendency toward easing up slightly. Retail trade registered a decline of 3 per cent from the previous week in the city, but the decrease in the rural areas was more moderate. Industrial activity continued to make steady gains. There has been a noticeable improvement among the larger manufacturers in construction work and plant remodeling. Youngstown Sheet & Tube Co. is spending a sizable amount on construction of a new strip mill. A considerable volume of new electrical equipment is being installed in several large packing plants on changeover work.

PWA awards made recently for school and public buildings include approximately $1,500,000 for electric apparatus. Purchases of central station supplies have increased substantially since the first of the year. New construction by utilities remains rather slow, but is expected to rise sharply during the spring. Additional REA allotments for line extensions in nearby rural areas total $725,000.

Electric range installations made steady gains during the past three weeks. Small appliances are selling in good volume and considerable emphasis is being placed on the new models of the larger items through special displays and advertising. Buyer attendance at the winter merchandise shows broke all records, with sizable orders placed for immediate needs. However, considerable caution still was displayed in commitments for more than 60 days ahead.

PACIFIC COAST

After their annual inventory and bookbalancing, Western wholesalers find lower stocks and about 20 per cent lower sales than a year ago, but a marked decrease in net profits due to increased taxes and expenses largely through tendency to place small single item orders in minimum quantities. Privately owned construction is showing little improvement. Industrial business is improving, recent orders having included $10,000 motors and controls for lithograph plant, additions to an oil refinery and an encouraging number of sizable maintenance material orders. The 1938 building permit volume placed five California cities among the 20 highest in nation, no other state having more than two. Much last quarter volume was due to PWA stipulation for start prior to January first, which will provide bulk of electrical contracts early this year.

The San Francisco exposition, three weeks prior to February 18 opening, has 85 per cent of its indoor exhibition space sold and 85 per cent installed, besides 90 per cent of its outdoor space sold and 60 per cent installed. Bonneville plant is furnishing much varied business in the Pacific Northwest, recent awards having included $75,000 disconnect switches, $16,500 insulators, $3,500 steel strand and $5,500 hardware for various sections, and $21,771 for crossarms and hardware for the Vancouver, Wash., to Eugene, Ore., section. The largest item, not yet awarded, covered 1,250,000 lineal feet of 250,000-circ-mil cable for the Salem to Eugene line, for which $138,755 was bid for aluminum and $140,543 for copper.

NEW YORK

Business in this area is taking a critical attitude toward the immediate outlook. Inventories are being kept relatively low and forward buying is spotty. Retail trade has failed to respond in any great volume, due in part to the severe cold weather. Weather conditions have been anything but good for construction activities.

Since last fall utilities have placed orders for a great amount of generating capacity. More is to be ordered in the near future. It is expected that when this equipment gets further along manufacturing activity will show a sharp rise.

Electrical appliances are being given a whirl and added stimulus from manufacturers. They expect a banner year, with new markets to be opened. REA is planning a gigantic appliance drive in the near future to load its lines. Since last July the REA has allocated more than $92,000,000 of its $140,000,000 for projects which are now in varying stages.

This week the financial markets were forced to absorb a high volume of liquidation. Prices dropped sharply. Quietness is expected to hold until the European situation clears.

NEW ENGLAND

Electrical equipment sales for this month compare favorably with last year. Switch and control apparatus orders placed recently in this district amounted to more than $80,000; two 10,000-kva. transformers were bought a short time ago and small motor buying is quite active. The Norwich, Conn., Lighting Department will add a 10,000-kva. steam turbo-generator with auxiliaries this year and also install a boiler of about 100,000 lb. per hour capacity.

Boston Elevated Railway has purchased for the new Everett, Mass., shops about fifteen motor-driven machine tools for metal working. Contracts for new construction involving a large volume of wiring supplies are being prepared for a large number of municipal institutions. Much modernization of house and apartment wiring is expected as a result of an inspection and checking program being conducted by the Boston Wire Department.

Merchandising shows an encouraging trend in appliance buying for the current month. During the past month more than 40 portable electric heaters and an encouraging number of small air-conditioning units were sold by one prominent distributor.

Plans are maturing for the sixth annual trade show at Boston Garden, March 8-10, under the auspices of the Electrical Manufacturers' Representatives Club of New England.

Vermont Looks at Power

[*Continued from page 38*]

is no way for Vermont to obtain its own money for its own needs except by surrendering what Vermont seems to regard as an important principle —the right to control its own electric business.

It's on all fours with the interesting device to prevent electric companies from getting a fair price for their systems when threatened with subsidized government competition. PWA can make a free gift of 45 per cent of the cost of building a *new* system and loan the rest of the money on easy terms. But it can give *nothing* for the purchase of an existing plant.

Why Governor Aiken is so annoying to the New Deal in this fight for Vermont to remain in control of her own electric facilities has already been shown. Other states more important politically to the New Deal have manifested an interest. The New Deal is just a little afraid that if it permitted Vermont to get away with something there would be plenty of followers. The Legislature of Oklahoma, since the Aiken episode, has decided it wants to take a look-see at the situation before permitting the federal government to intervene in its electric business.

A $54,000,000 project has been authorized for the Denison Dam, on the Red River. Actually, present work is on the plans and specifications. Construction could not be started until after the end of the present fiscal year, June 30. But Oklahoma now wants to make sure about this power control situation before permitting dam construction to start. Here, as in Vermont, the power is "incidental." Flood control is supposed to be the paramount objective.

Maybe it's an honest conviction that local control is better than remote dictatorship from Washington. Maybe it's just some politicians thinking they would rather control a juicy plum themselves. Either is bad news to the New Deal.

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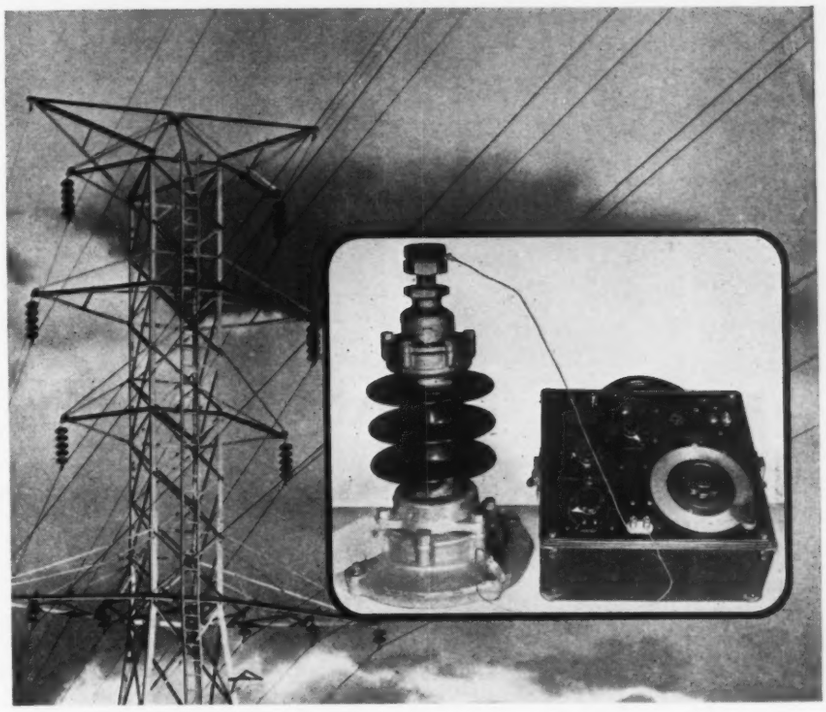
Spokane Gets Wiring License

Spokane, Wash., Adequate Wiring Bureau has been licensed to certify adequately wired homes, becoming the twentieth city to be so licensed. H. C. Bender of the Washington Water Power Company is secretary of the bureau.

New Capacitance Test Bridge



Now Available With One Terminal Grounded to Facilitate Capacitance and Power Factor Measurements in the Power Field

To meet the demands of the public utility field, the G-R Type 740-B Capacitance Test Bridge has been modified to increase its usefulness to the power man. The bridge is now equipped with one unknown terminal grounded.

This is the only 60-cycle portable and self-contained bridge with one grounded terminal; it is especially suitable for the service man to take out into the field for routine maintenance measurements. It can now be used for the measurement of capacitance in the presence of moderately strong electrostatic fields.

The modified bridge is listed as the Type 740-BG. It is very convenient and simple to use in making capacitance and power-factor measurements on cables, transformer bushings, winding-to-sheath or to-ground capacitance of transformers, conductor-to-sheath or to-ground capacitance of cables, and measurements on porcelain and compound-filled insulators.

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Sales Opportunities

ROCK ISLAND, ILL.—Peoples Power Company, Moline, Ill., plans extensions and improvements in steam-electric power plant at Rock Island, including installation of additional equipment. Cost estimated close to $300,000. Company also plans modernization of local power substation at Second Avenue and Twenty-third Street, with installation of new transformers, switchgear and auxiliary equipment. Cost approximately $100,000. Both projects are scheduled to be carried out in 1939.

CONCORD, N. C.—Duke Power Company, Charlotte. N. C., plans extensions in transmission line from point near Georgeville to vicinity of Concord, including additional substation facilities for increased service in latter district. Right of way is being secured and work is scheduled to begin soon. Company has plans maturing for new steam-electric generating plant on site recently secured near intersection of Main and Broad Rivers, Cliffside, N. C., and will start work early in February. Station will be equipped for an initial capacity of 80,000-kw. Cost estimated over $1,000,000.

BONNEVILLE, ORE.—J. D. Ross, administrator, Bonneville project, Department of Interior, Portland, Ore., receives bids until February 9 for 131,500 lineal feet of conductor for transmission lines. Also for quantity of connectors, dead-ends, tapered armor rod assemblies and accessory equipment (Circular 129).

SIBLEY, IOWA—Receives bids until February 8 for extensions and improvements in municipal electric power plant, including new 750-kw. steam turbo-generator unit and accessories, surface condenser, cooling tower, switchgear and auxiliary equipment. Cost estimated over $150,000. Young & Stanley, Inc., Muscatine, Iowa, is consulting engineer.

SPOKANE, WASH.—Washington Water Power Company has authorized an appropriation of about $1,425,000 for expansion and improvements in power plants and system during present year, of which a large part will be used for extensions in primary and secondary lines for rural electrification, including power substation and service facilities. Plans are being completed for rebuilding of 13,000-volt transmission line from Okanogan to Omak, Wash., and for extensions and improvements in distribution system at last noted place, with additional power substation facilities.

ROCK ISLAND, ILL.—International Harvester Company, 180 North Michigan Avenue, Chicago, Ill., plans installation of heavy-duty motors and controls, switchgear, transformers and accessories, electric hoists, conveyors and other equipment in connection with expansion and improvements in "Farmall" tractor-manufacturing plant at Rock Island, including erection of several new buildings. Cost estimated close to $5,000,000. Similar equipment will be installed in branch gasoline engine plant at Indianapolis, Ind., where an extension and improvement program also will be carried out. Cost reported approximately $1,000,000. Both projects will be carried out in 1939.

BALTIMORE, MD.—Consolidated Gas, Electric Light & Power Company has authorized an appropriation of about $5,008,000 for expansion, improvements and replacements in plants and system during 1939, of which more than $3,500,000 will be expended in electrical division and remainder in gas and steam departments. Work will include extensions in overhead and underground transmission and distributing lines, as well as additions to rural electric system in different parts of territory, power substations, service facilities and other installation. Company has begun enlargement of steam-electric generating station at Westport to increase capacity by 33,000-hp., previously referred to in these columns, and will make an estimated gross expenditure at this plant of about $3,600,000 in 1939 and 1940, when work is scheduled for completion. Extensive additions will be made to switchyard at station, with installation of equipment for increased capacity. Project will include extensions in transmission lines, as well as power substations and distributing system.

LOS ANGELES, CALIF.—Los Angeles Water and Power Bureau has preliminary plans under way for new power substation for distribution service in Hancock Park, to be known as substation No. 40, estimated to cost about $629,000, of which approximately $420,000 will be used for equipment installation, including transformers, switchgear, etc., and for line connections. Also plans new power substation for similar service in Sunland district, estimated to cost about $180,000, of which approximately $105,000 will be used for equipment installation and line connections. Work is scheduled to begin soon on new electric repair shop at wire and service plant at 1630 North Main Street, to cost approximately $564,000, of which $105,000 will be used for equipment purchases.

CAMBRIDGE, MINN.—Is considering a report made by Ralph D. Thomas Associates, Inc., 1200 Second Avenue South, Minneapolis, Minn., consulting engineer, following recent surveys, recommending construction of a municipal-owned electric power plant at estimated cost of about $200,000. Early decision will be made to allow for work in spring.

DAYTON, OHIO—Quartermaster Corps, Wright Field, Dayton, plans early call for bids for new power plant at local field. Also for test hangar building and other structures. Appropriation has been authorized.

ST. LOUIS, MO.—Gaylord Container Corporation, 2820 South Eleventh Street, plans installation of motors and control, conveyors, electric hoists and other equipment in new plant at Second and Dorcas Streets for production of folding paper boxes and containers. Group of five buildings, totaling 100,000 square feet of floor space has been leased at location noted, and will be modernized and improved at once, and additional one-story structure erected. Entire project reported to cost over $175,000.

VANCOUVER, WASH.—J. D. Ross, administrator, Bonneville project, Department of Interior, Portland, Ore., will take bids soon for construction of steel tower transmission line from Bonneville hydroelectric power station, Bonneville, Ore., to Vancouver, about 219 miles. Large power substation and switching station will be built at latter place.

CINCINNATI, OHIO—Cincinnati Gas & Electric Company plans early construction of new steel tower transmission line from connection at Columbia Park to point near College Corner, Ohio, near Ohio state line. Cost estimated over $500,000. This will be part of a 1939 expansion program of company.

PINE RIVER, MINN.—Is considering extensions and improvements in municipal electrical power plant, including installation of new generating unit and auxiliary equipment.

Municipal Plants

SCOTTSBORO, ALA.—Application for an injunction to prevent construction of a municipal electric distribution system has been filed by the Alabama Power Co. Work on the new system was begun in December after the city received a federal grant of $138,000.

BRISTOL, CONN.—Howard B. Wilson, president of the Plainville (Conn.) Electro-Plating Co., has been elected chairman of a special committee which will investigate and study the feasibility of establishing a municipal power plant. The advantages and disadvantages of a municipal power plant will be determined and a complete report will be sent to the city council.

MELBOURNE, FLA.—City has issued a call for an election to be held February 7 to decide if the city is to have a municipal electric light plant. Notice of the election and an ordinance providing for the ownership of the light plant have been published. At a meeting of the city commission Clyde A. Byrd, district manager of the Florida Power & Light Co., asked to be put on record as opposing, as a taxpayer, the adoption of the ordinance and the calling of an election, contending that the operation of the plant would not prove economical to the city, and promising that the question of adequate street lighting could be satisfactorily worked out within a short time.

PADUCAH, KY.—A new electric franchise embodying provisions for rate reductions and an option under which the city might purchase the facilities of the Kentucky Utilities was recommended to the city board of commissioners by Dr. John Bauer, New York. Dr. Bauer suggested that if the company will not accept the fundamental provisions of the franchise that the city should initiate steps to either purchase the company's Paducah plant or build a municipal plant and distribution system. When the contract was drawn up, however, the utility declined to bid, because the contract stipulated that the city would regulate rates and hold an option to buy the utility's plant after the first five years. In an opinion addressed to the Kentucky Utilities Co., Assistant Attorney-General J. W. Jones of Kentucky held invalid parts of the proposed ordinance. He said parts to which he objected tended to divest the State Public Service Commission of its power to regulate rates in the city and give it to the city.

SYRACUSE, NEB.—Light and power consumers were given a belated Christmas present recently by the city council when it voted to rebate all December energy bills 50 per cent as a token of appreciation for the patronage during 1938.

CYGNET, OHIO—For the third time in thirteen months the Board of Public Affairs has rebated a month's bills to patrons of the municipal light plant.

BELLEVUE, OHIO—Steps to condemn the power and light distribution system of the Ohio Public Service Co. in this city are being taken by attorneys and engineers following unanimous approval by City Council. After negotiating for a year, in which more than 40 conferences were held with company representatives, council voted to start the condemnation action and also to abandon plans for a PWA grant for a $680,000 municipal power plant program. Council said the city will concentrate on acquiring the distribution set-up and will buy electricity wholesale from some other power source. The city has offered the company $115,000 for the distribution sys-

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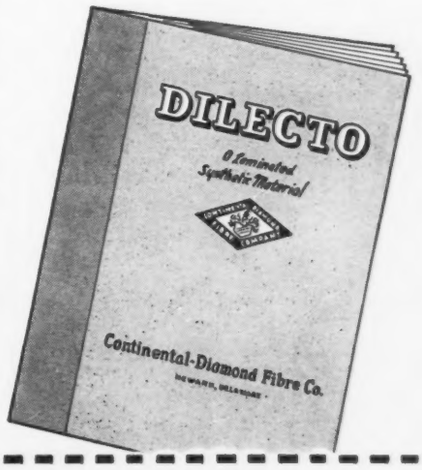

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tem, but the offer was rejected, company officials indicating they were preparing for a long legal battle to resist the city's move.

SMITHVILLE, TEX.—The city has assumed ownership and management of the electric and water systems in this city, following completion of a purchase deal with the Texas Public Service Co. for $230,000. The city will purchase power from the Texas Power & Light Co. until Lower Colorado River power becomes available.

CUERO, TEX.—A protest questioning the legality of the city's recently voted $150,000 bond issue for construction of a municipal electric power distribution system has been filed by the Central Power & Light Co. The protest questioned authority of the city council to call such a bond election and alleged illegal voting, irregularities in the appointment and actual conduct of election judges, and charged that proper and timely notice was not given before the election was called.

Recent Rate Changes

NEBRASKA POWER CO.'s new schedule of power rates, which reduces charges for larger users of power in one commercial schedule and establishes two new commercial schedules, has been accepted by the Omaha city council. Roy Page, vice-president of the company, told the council the new rates would bring savings of between $110,000 and $112,000 a year to approximately 2,000 commercial users.

OHIO EDISON CO.'s new schedule of residential power rates, which will save about $50,000 a year for about 55 per cent of the 20,000 customers of the company in the suburban area of Youngstown, has been approved by the state Public Utilities Commission. New rates also affects users in suburban areas of Akron, and users outside of the municipalities of Youngstown, Poland, Campbell, and Struthers. The new schedule applies to all suburban users the "objective rate" under which about 45 per cent of them already have been using power. Schedule will benefit those who have been billed under the old "immediate" rate. The new rate is: $1 a month, for the first 20 kw.-hr. or less; 4½ cents per kilowatt-hour for the next 30 kw.-hr.; 3 cents per kilowatt-hour for the next 50; 2 cents per kilowatt-hour for the next 100; and 1½ cents per kilowatt-hour for all in excess of 200.

DURHAM PUBLIC SERVICE CO. will reduce its electric rates February 1 by an amount that will save customers an estimated $45,000 a year. Under the new scale, the new rate will be as follows: $1 for the first 12 kw.-hr.; 4 cents per kilowatt-hour for the next 38 kw.-hr.; 2.5 cents per kilowatt-hour all in excess. A 5 per cent penalty may be imposed on delinquent accounts. Commercial users will get a reduction from $2.13 to $1.62 for 25 kw.-hr.; from $3.25 to $2.75 for 50 kw.-hr.; from $5.50 to $5.00 for 100 kw.-hr. and from $10 to $9.50 for 200 kw.-hr. Stanley Winbourne, North Carolina utilities commissioner, said the savings would amount to about $30,000 yearly for residential customers and $15,000 yearly for commercial users. R. L. Lindsey, vice-president and general manager of the company, said in the announcement covering the rate reduction, that his company has made a consistent effort to cut rates wherever possible and that his was the second reduction made during the year.

JERSEY CENTRAL POWER & LIGHT CO. has filed a revised schedule with the New Jersey Board of Public Utility Commissioners, effecting a reduction in rates of $67,620. The revision, available to yearly commercial customers, was filed under stipulation by the board that permission to file should not in any way prejudice pending investigation of rates and hearings or other proceedings pursuant to a November 23, 1938, board order.

SOUTH CAROLINA ELECTRIC & GAS CO., following an order by the state Public Service Commission to reduce its rates to effect for the consumers savings of approximately $510,000 a year on power in all categories, has objected on the grounds that to put the lower rates into effect would amount to "confiscation" of its property. The objection threw the case into public hearings. A delay has been granted the company in order that it might be able to prepare its reply and in order that it would have time to furnish information requested by the commission. Hearing called for January 3 was recessed and the exact date for resumption of hearings has not been set.

NORTHWESTERN PUBLIC SERVICE CO.'s reduction of 14 per cent in rates charged consumers in North Platte, Neb., has been approved by the city council. The reduction represented a compromise agreement, with the city asking first for a 15 per cent reduction, and the company offering one of 12½ per cent. The reduction will effect a saving estimated at $31,324 annually.

GREENWOOD, MISS., will put into effect March 1 new electric rates, estimated to save customers of the municipal plant approximately $30,000 annually. The new schedule affects both residential and commerical users.

MARYLAND PUBLIC SERVICE COMMISSION has announced that electric rate reductions totaled more than $70,000 in 1938, despite somewhat adverse conditions. A hint of further reductions was also made by the commission. "Informal negotiations have been undertaken by the commission in those instances where preliminary studies have seemed to show the possibility of some rate adjustments and, while these negotiations have not reached the point where the commission can at this time definitely report that rate reductions have been accomplished, it is the confident expectation of the commission that they will be concluded satisfactorily in the near future," the report stated.

MONTREAL LIGHT, HEAT & POWER CONS. has made an annual reduction of $400,000 in electric rates beginning February 1, the reduction going to small merchants and industries to whom the tariff known as general or commercial now applies, according to an announcement made by Maurice Duplessis, Premier of Quebec. The Premier also said the corporation of the city of Montreal will benefit as well eventually from a lowering of rates amounting to several hundred thousands of dollars a year. The Electrcity Board, meanwhile, he added, is continuing its general study of rates. It was the Quebec Electricity Board that studied the rate structure of the Montreal utility and submitted the report which resulted in the $400,000 reduction.

Residential Load Gains 7%

Average Kilowatt-hour sales per residential customer of the Georgia Power Company totaled 1,398.8 for the twelve months ended December, 1938, an increase of 85.5 kw.-hr., or 6.5 per cent, during the year.

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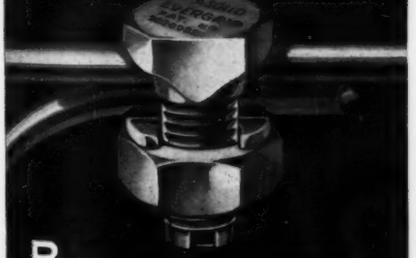

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JASPER BLACKBURN PRODUCTS CORP.
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Predicts Flood-Stage for Distribution Emergency

[*Continued from page 21*]

cipitation that enters the reservoir a few miles above Cincinnati will naturally flow out ahead of precipitation at points farther up the river. Determination of flood stage in a smaller reservoir would involve a calculation of cross-section area, rate of flow and volume of precipitation in various areas accounted chronologically.

Although the Ohio River drainage area may be visualized as a large reservoir, it must be borne in mind that it is so vast that the immediate leveling effect that would be noted in a smaller body of water does not take place. For simplification in calculating the amount of water that must pass, the rate of flow at the outlet is assumed to be uniform over the entire route. The next step is then to take into account the retarding or storage effect.

In the development of this method this accumulation of water in the valley reservoir is called "surplus." Determination of this surplus is the basis of the curves used in the predictions and it is based entirely on empirical analysis. Its importance in the calculations is shown by the fact that on one day during the 1937 flood more than 300,000 sq.ft. cross-section of water would have been scheduled to pass Cincinnati, meaning a crest of more than 160 ft.

For our purposes, the total area was divided into 41 districts, on which we can get precipitation data from the U. S. Weather Bureau. In addition, the area is divided chronologically; that is, by the average number of days at a uniform rate of flow for water to reach Cincinnati.

Example of calculation and prediction

A special tabulation sheet is used to minimize the work and chances of error in making the calculations. On this sheet is shown each location for which rainfall data are to be obtained and its corresponding multiplying factor. The product of rainfall in inches times the factor is carried to the column for the day when that water will reach Cincinnati. The total of this column is the cross-section reference figure. The remaining operations follow Fig. 2.

For example, the following rainfall times multiplying factors contributed

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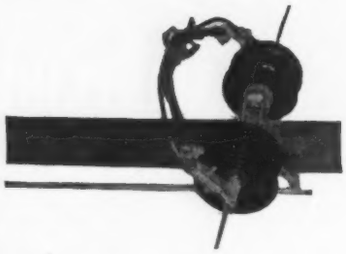

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to the prediction of January 24, for January 25, 1937:

	Products
Jan. 20—total for 5 points above Pittsburgh	96.9
Jan. 21—total for 8 points around Dam 10	43.8
Jan. 22—total for 10 points around Parkersburg	36.7
Jan. 23—total for 10 points around Pt. Pleasant	26.9
Jan. 24—total estimated for 7 points between Portsmouth and Cincinnati	104.0
Total cross-section	308.0
River stage Jan. 24—73.4 ft. From curve 1 (Fig. 2) this stage corresponds to cross-section	625.0
	933.0
From curve 2 (Fig. 2) this cross-section gives river stage prediction, ft.	78.4

Adaptability of method of prediction

Floods at Cincinnati may start from: (1) Run-off of snow and ice plus rainfall in the upper drainage area of the Ohio River, or (2) heavy rainfall in that area. After the start, or possibly at about flood-stage in Cincinnati, further rises apparently depend on continued heavy rainfall. This method must assume that the major part of the snow and ice contribution is a part of the surplus water up the river at the beginning of the flood in Cincinnati and that the further rises can be calculated from the daily precipitation.

As a further amplification of this study, it may be possible to use the river stages at Pittsburgh and possibly Point Pleasant as basic data for the predictions at Cincinnati and thus to a reasonable extent lessen the amount of data required from the drainage areas beyond these points, which would include ice and snow.

This same method can be used for Louisville and other points on the Ohio River, by using the Cincinnati data as a base and making the necessary corrections for individual conditions. The same method would seem to be adaptable to any large drainage area. A program of co-operation in exchange of information among the power companies in the river valley may be desirable, since we are strategically well equipped to gather data over wide areas.

In working on this method of prediction we have had the co-operation of the local office of the U. S. Weather Bureau, which has furnished the record data on past floods. It has also assured us of close co-operation in furnishing rainfall data for application to the prediction calculations.

Heat Exchangers Cool Transformers

[*Continued from page 35*]

viously described were used to provide the greater cooling which was required.

Experience of more than a year with the two types of equipment indicates that under the worst conditions of excessive ambient temperatures the transformer temperatures have not exceeded 53 deg. C.

In order to keep the oil in the air-over-oil type transformers free from sludge resulting from oxidation of the oil, a portion of the oil is bypassed through a filter consisting of a 10-in. pipe 4 ft. long, containing a canvas sack filled with 50 lb. of activated alumina. This effectively removes the acidity produced by oxidation. The normal rate of increase of acidity in the 2,500-kva. transformer is 0.2 neutralization number per year. The activated alumina is replaced with freshly reactivated material once a year. This treatment with activated alumina is necessary to reduce the maintenance caused by clogging of lines and coolers by sludge which would otherwise be formed and would tend to deposit on any surface where there is a marked differential in temperature. The oxidation of oil is very slow in the conservator and the inert gas type transformer and, consequently, should not require use of the filter.

Power same as for pond

Very little difference was found in the amounts of power required to provide water cooling as compared to that used by the heat exchangers. The largest difference found in costs was the fixed charge for the water mains and spray pond. In an existing layout this cost would be controlling in the event that additions were needed for a system already operating near capacity. In one location space was not available for the radiators, but the heat exchangers could be accommodated.

In general, there is little competitive advantage between self-cooled and heat-exchanger-cooled transformers in sizes below 5,000 kva. In larger sizes there seem to be definite advantages in favor of self-cooled transformers, in which there is usually ample room for the radiators. There are many opportunities for the use of heat-exchanger cooling in

solving problems in connection with improvement or redesign of existing installations, particularly where tank connections are available and the transformers are not kept out of service for long periods for revision.

•

Great Britain Makes Plans for Electrical Reserve

Discussions have been taking place in Great Britain between representatives of public utility undertakings and government officials as to special measures to be taken as a precaution against a national defense emergency.

In the case of electrical utilities the conclusion has been reached that the most practical measure will be the provision of a national reserve of switchgear, transformer and incidental equipment, to be readily available for installation where required, to be held at suitable centers and to be under the administration of the Central Electricity Board.

•

Algeria Plans Construction of Hydro Facilities

The dam at Oued Fodda, near Algiers, has been selected as the site of the first hydro-electric power plant in Algeria and appropriations are to be made annually until all the larger dams are equipped, according to a report from the American Consulate at Algiers, made public by the Department of Commerce.

At the beginning of 1938 the government of Algeria initiated a scheme for utilizing the larger dams originally constructed for irrigation purposes to furnish hydro-electric power also, the report stated. The scheme is being financed for the present by a tax of 4 per cent on all electric power now being produced by coal- and oil-operated plants, according to the report.

•

Columbia University Courses

The School of Architecture of Columbia University will again offer in University Extension this coming spring session a varied group of courses, including two courses in air conditioning and a course in the illumination of buildings. One air-conditioning course will be basic, presenting the elements of air conditioning and the other is a technical course giving detailed consideration to the selection of air-conditioning equipment. The department of electrical engineering is offering the course in building illumination which presents the most recent information in modern lighting practice.

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Load Center Transformers Aid Factory Relighting

[*Continued from page 34*]

transformers of 100 kva, and one of 75 kva. These six Pyranol transformers have been mounted (Fig. 3) on steel platforms hung from floor columns. In this position they take no floor space, interfere with no cranes or lighting and are readily accessible for maintenance and adjustment. In one case (Fig. 4) it will be noted that the building is of sawtooth construction and the transformer platform is placed in a sawtooth. This was in building C (Fig. 2).

In order further to deliver good, well-regulated voltage for the lighting needs induction regulators were installed at the substation to serve buildings A and B. Each was 24 kva., with range of 10 per cent buck and boost in the primary circuit. In building C one of the new AIRS 60-cycle regulators was installed and mounted on the same platform with each of the Pyranol transformers, to hold illumination at proper levels regardless of variations in the lighting load, or in power load supplied from the same primary bus. These are air-cooled regulators, each rated 12 kva., 500/500 amp., 115/230 volts, three-wire, and 10 per cent buck and boost range.

The new restaurant building (D in Fig. 2) obtains its supply from the substation (marked E in Fig. 2). It likewise involved a long feeder run under the existing set-up. Installation of two 150-kva. transformers as shown effected savings in installed cost comparable to those detailed for the other buildings.

Benefits gained from these installations have already established the decision to give thorough consideration to Pyranol transformers at points of load center, especially where relighting to modern standards demands a superior regulation of voltage.

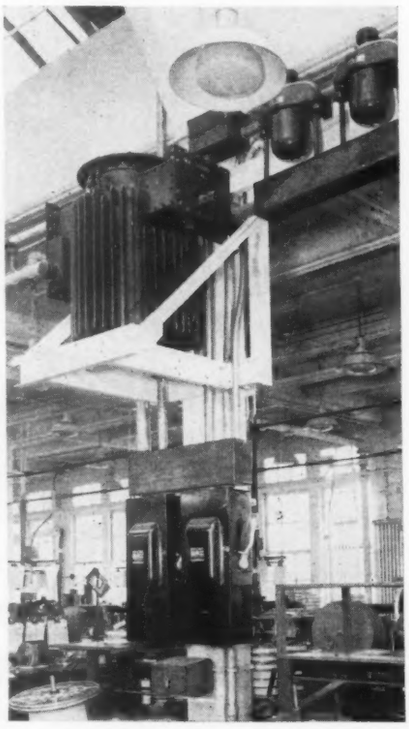
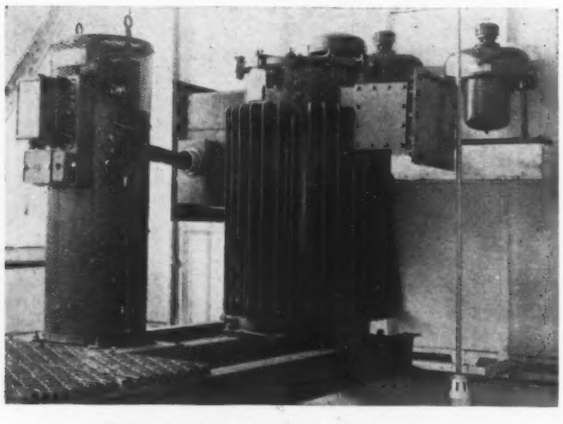


Fig. 3—Pyranol transformers mounted in elevated racks

The 2,300-volt, single-phase line comes to the transformer through a G.E. oil fuse cutout (right) in each line wire. The secondary is connected to two 400-amp. Trumbull type A safety switches, each controlling the supply of Trumbull multibreaker load centers in the two halves of illuminated area.

Indoor installation of Pyranol transformers without the use of expensive fireproof vaults is permissible under the National Electrical Code. The installation is safe, because Pyranol is a non-inflammable, non-explosive transformer cooling and insulating liquid and because all live parts are metal-inclosed. The transformer is located at the load center without occupying floor space that is valuable for production.



As with the transformer, best results are also obtained by placing the regulator at the load center. This is possible with air-cooled regulators, as the code allows them to be installed in the same manner as Pyranol transformers. The regulator is completely equipped to provide automatic regulation over the range of 10 per cent raise and 10 per cent lower. As it holds the voltage constant within ± 1 volt, it makes possible illumination of extremely high quality.

Fig. 4—Air-cooled induction regulator in secondary circuit of Pyranol transformer

Precise Meter Layout for Precision Results

[*Continued from page 29*]

sists of 2½-in. blocks laid on ¼-in. mastic. The offices are floored with colored asphalt tile, while walls and floor of the wash room are of Terrazza.

Convenience and safety

Arrangement of rooms is such that it is unnecessary to shuttle equipment back and forth, one purpose of the layout being to preserve continuous forward motion. Thus a truck returning to the shop with used meters pulls up to the loading platform, opposite the door to the repair shop. Here the meters are loaded onto one of the four-deck hand trucks, taken into the repair shop, and there segregated. Check tests are made and restorable equipment is repaired and painted. Meters that are to be retired are stored in the shop until junked. This procedure eliminates further handling as well as preventing the possibility of old or discarded meters being tested or returned to service.

After being checked, cleaned, repaired and converted to socket type, the restorable meters are moved to the test department for final test and adjustment. They are then stored there until such time as they are needed for installation.

A stroboscopic test board has been installed and laboratory equipment is scheduled which will make it possible to perform any test essential to the department.

The workday starts with the arrival of one employee at 7 a.m. Transportation equipment is delivered by the transportation department by 7:30 a.m. Thus vehicles are loaded and ready to start at 8 a.m. and are due back at 4:30 p.m., when the workday ends.

The department's personnel includes superintendent and assistant, three clerks, two foremen, protection engineer, electrolysis engineer, demand meterman, ten linemen, two apprentice linemen, three electricians, special tester, eight meter testers, apprentice meter tester, six helpers, time-switch inspector, two instrument mechanics, thirteen suburban troublemen and two relief suburban troublemen, a total of 59 employees.

During an average year the department handles about 130,000 work orders. To evaluate the effect of the new plant on this volume of work,

especially when it involves such a variety of operations, is next to impossible. It has been observed, however, that the time of many operations has been reduced as much as 30 per cent. And the improvement in accuracy, efficiency and morale of department personnel has more than justified the investment.

Process and Power Steam Geared to Holyoke Hydro

[*Continued from page 27*]

18,629,000 kw.-hr. at an average price of 1.10 cents (an average 24-hour load of about 2,000 kw.).

When the load conditions require the installation of a topping turbine with the raising of the boiler pressure to 750 lb., use of the automatic control over the entire range of boiler capacity up to 250,000 lb. per hour, and associated co-ordination of these most modern steam-generating and power-producing facilities with the industrial steam, hydro and power loads, the resulting economies in operation should put the company's plant assembly on a high plane of efficiency.

•

Akron Certifies First Home

Launching the local certification and publicity program, the Adequate Wiring Bureau of the Akron, Ohio, district recently issued its first wiring certificate. An industry dinner attended by more than 100 followed the presentation.

•

Special Contract Opposed

Fulton Light, Heat & Power Co. has been charged by the New York Public Service Commission with violating the law through what it termed a "special contract" with Oswego Falls Corp. The commission explained the special contract covers rates for power furnished the Oswego company, owner of a wood pulp and paper mill, and said a formal proceeding will be instituted against the power company "unless the condition is remedied."

•

Utility Has "Package Sale"

Montreal Light, Heat & Power Consolidated is having a "package sale," consisting of a floor lamp, radio, iron and toaster, which is being sold at approximately 50 per cent off the list price. The company feels that the loss on the sale and the cost of promotion will be more than offset by the additional revenue.

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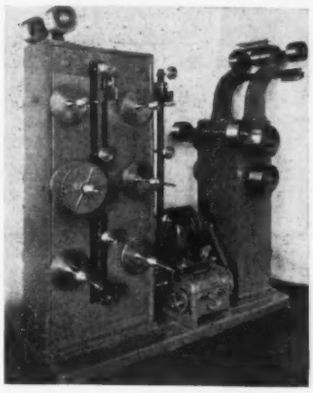

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Allots $8,037,500 to Rural Projects

REA has alloted $8,037,500 for 62 rural electrification projects in 22 states. This brings the total of allotments made since REA was established in 1935 to $180,600,200. Among the allotments were the following:

ARKANSAS—C & L Rural Electric Co-operative Corp., Star City, C. E. Boyd, president, $177,000 to build 162 miles of line, 681 members in Lincoln, Cleveland, Grant and Jefferson counties.

ILLINOIS—Wayne-White Counties Electric Coop., Fairfield, C. W. McCullough, superintendent, $255,000 to build 245 miles of line, 766 members in Wayne, Edwards, White, Jefferson, Gallatin and Hamilton counties. Illinois Rural Electric Co., Winchester, H. G. Bryan, supervisor, $329,000 to build 334 miles of line, 988 members in Calhoun, Scott, Pike, Morgan, Nacoupin, Jersey, Greene and Cass counties. Menard Electric Co-operative, Petersburg, A. E. Becker, superintendent, $140,500 to build 136 miles of line, 376 members in Sangamon, Mason, Mass, Morgan and Logan counties. McDonough Power Co-operative, Macomb, Ray Grigsby, superintendent, $164,000 to build 157 miles of line, 461 members in Warren and Henderson counties. Western Illinois Electrical Co-operative, Carthage, Mrs. Ruth Stevenson, president, $403,000 to build 366 miles of line, 1,271 members in Hancock County.

INDIANA—Harrison County Rural Electric Membership Co-operative, Corydon, Arthur S. Miller, president, $387,000 to build 342 miles of line, 1,267 members in Harrison and Floyd counties.

IOWA—South Crawford Rural Electric Co-operative, Manning, Harry W. Frank, superintendent, $164,000 to build 145 miles of line, 349 members in Carroll, Sac and Crawford counties. Butler County Rural Electric Co-operative, Allison, E. N. Neal, superintendent, $126,000 to build 112 miles of line, 266 members in Butler, Bremer and Floyd counties.

KENTUCKY—Inter-County Rural Electric Co-operative Corp., Danville, John V. Swaim, superintendent, $114,000 to build 102 miles of line, 465 members in Lincoln, Boyle, Marion, Mercer, Garrard, Nelson and Casey counties. Warren Rural Electric Co-operative Corp., Inc., Bowling Green, Lester Wright, superintendent, $172,000 to build 167 miles of line, 769 members in Ohio, Butler, Warren, Edmonson and Simpson counties.

LOUISIANA—Southwest Louisiana Electric Membership Corp., Lafayette, Harry B. Bowles, superintendent, $130,000 to build 153 miles of line, 470 members in Lafayette, St. Landry, St. Martin, Acadia and Vermillion Parishes. Pointe Coupee Electric Membership Corp., New Roads, Harry Melancon, president, $124,000 to build 125 miles of line, 505 members in Pointe Coupee Parish.

MICHIGAN—Southeastern Michigan Rural Electric Co-operative, Inc., Adrian, C. C. Nye, superintendent, $104,000 to build 100 miles of line, 300 members in Fulton county. Presque Isle County Electric Co-operative Assn., Posen, Albert Hall, superintendent, $195,000 to build 144 miles of line, 574 members in Alpena, Presque Isle and Montmorency counties.

MINNESOTA—Crow Wing Co-operative Power & Light Co., Brainerd, D. Watson Moir, superintendent, $306,000 to build 232 miles of line, 939 members in Crow Wing and Cass counties.

MISSOURI—Northwest Missouri Electric Co-operative, Savannah, J. Ray Lambright, superintendent, $240,000 to build 219 miles of line, 619 members in Nodaway, Andrew, Buchanan, DeKalb, Clinton, Holt and Gentry counties. Atchison-Holt Electric Co-operative, Rockport, Bruce S. Gibbs, superintendent, $145,000 to build 141 miles of line, to serve 371 members in Atchison, Nodaway, and Holt counties, Mo., and Page county, Iowa. Tri-County Electric Co-operative Assn., Lancaster, Charles D. Miller, president, $344,000 to build 293 miles of line to serve 913 members in Scotland, Schuyler, Adair, Putnam counties, Mo., and Davis county, Iowa. Platte-Clay Electric Co-operative, Inc., Platte City, A. D. Davis, president, $487,000 to build 456 miles of line, to serve 1,367 members in Platte, Clay, Clinton and Ray counties.

NEBRASKA—Merrick County Rural Public Power District, Central City, R. D. Mesner, president, $120,000 to build 112 miles of line, 267 members in Merrick county. York County Rural Public Power District, York, Nat R. Simmons, president, $271,000 to build 237 miles of line, 608 members in York and Seward counties. Northeast Nebraska Rural Public Power District, Emerson, Theodore Rhode, president, $306,000 to build 286 miles of line, 659 members in Thurston, Dakota, Dixon and Wayne counties.

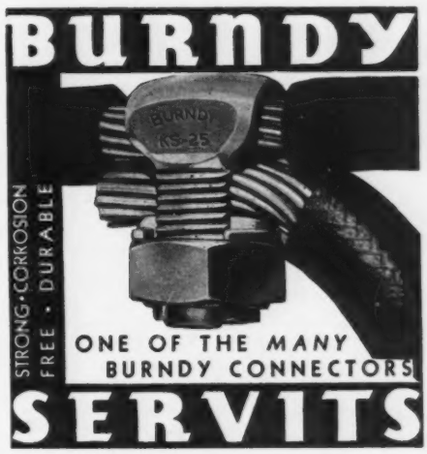
OHIO—Inter-County Rural Electric Co-operative, Inc., Hillsboro, Victor Miller, superintendent, $230,000 to build 154 miles of line, 793 members in Highland, Adams, Brown and Clermont counties.

OKLAHOMA—Kay County Electric Co-operative, Inc., Blackwell, George A. Fry, manager, $124,000 to build 146 miles of line, 365 members in Grant, Kay and Noble counties. Caddo County Electric Co-operative, Albert, Billie Bryan, superintendent, $321,000 to build 336 miles of line, 1,004 members in Caddo, Canadian, Grady, Kiowa, Washita, Custer and Blaine counties. Inter-State Co-operative Electric & Power Co., Ada, R. N. Harper, superintendent, $198,000 to build 203 miles of line, 627 members in Hughes, Garvin, Coal, Johnson and Pontotoc counties.

TENNESSEE—Upper Cumberland Electric Membership Corp., Carthage, J. B. Cassetty, president, $110,000 to build 103 miles of line, 621 members in Jackson, Smith and DeKalb counties.

TEXAS—Kaufman County Electric Co-operative, Inc., Kaufman, Jilson McCullough, superintendent, $111,000 to build 115 miles of line, 453 members in Kaufman, Van Zandt and Henderson counties. Fayette Electric Co-operative, Inc., LaGrange, George E. Adamcik, superintendent, $122,000 to build 134 miles of line, 399 members in Fayette, Washington and Austin counties. Greenbelt Electric Co-operative, Inc., Wellington, Tex., Harry Patterson, president, $131,000 to build 146 miles of line, 434 members in Collingswoth and Donley counties, Tex., and Harmon county, Okla. Midwest Electric Co-operative Association, Rotan, Sterling Willingham, president, $137,000 to build 155 miles of line, 352 members in Fisher and Scurry counties.

WISCONSIN—Grant County Co-operative Rural Electric Association, Lancaster, Earl E. Raisbeck, superintendent, $142,000 to build 127 miles of line, 355 members in Grant county. Polk-Burnett Electric Co-operative, Balsam Lake, Wayne F. Kelly, superintendent, $341,000 to build 305 miles of line, 1,010 members in Burnett, Barron, Polk and St. Croix counties.



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ENGINEER WANTED. Experienced in detail design of electric cranes, hoists and structures with not less than 10 years experience in this line. State fully, experience, age, salary expected, etc. P-583, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ENGINEER WANTED 30 to 35 years of age thoroughly familiar with distribution system, design, and maintenance. Should have had some experience in transmission line and station work. Location Utility in Southern States. P-584, Electrical World, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

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POSITIONS WANTED

(See also "Selling Opportunities Wanted")

ENGINEER SUPERINTENDENT 16 years experience, design, construction, operation, Diesel, Hydro, steam plants and systems. Familiar public relations, industrial problems seeks new connections Superintendent Municipal System. PW-574, Electrical World, 520 No. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER, two years Lamp experience, age 25, married, desires position with reputable concern. Resume and references furnished. C. L. Loomis, 465 Hasting Street, S. Williamsport, Pa.

ELECTRIC UTILITY MANAGER. Twelve years experience. Excellent record of Public and Employee relations. Experienced in sales, accounting, personnel, and management work. PW-582, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER: 6 years experience construction and maintenance of stations, and transmission and distribution system. Desires new connection with utility, contractor, or manufacturer. PW-585 Electrical World, 520 N. Michigan Ave., Chicago, Ill.

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Salesmen—Additional Lines

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RESISTANCES. Carborundum, Carbon Compound, Negative Voltage Characteristics, etc. London firm seeks sole agency for England. Littlejohn Electrical Company, 94 Charlotte Street, London, England, W.1.

OFFICIAL PROPOSALS

Bids: February 7 (56)

Meter Accessories, Tools and Supplies

P.W.A. PROJECT DOCKET NO TENN. 1105.-P-DS
ELECTRIC DISTRIBUTION SYSTEM
SUB-PROJECT—CONTRACT NO. 7-M
CITY OF CHATTANOOGA
ELECTRIC POWER BOARD OF CHATTANOOGA
CHATTANOOGA, TENNESSEE

Sealed proposals for the furnishing and delivering of Sub-Project—Contract No. 7-M of the Electric Power Board of Chattanooga, acting for and on behalf of the City of Chattanooga, Chattanooga, Tennessee.

P.W.A. Project Docket No. Tenn. 1105-P-DS
Electric Distribution System
Sub-Project—Contract No. 7-M

will be received by the Electric Power Board of Chattanooga, Chattanooga, Tennessee, at the office of the Secretary of the Electric Power Board of Chattanooga, Municipal Building, Chattanooga, Tennessee until 1:30 P. M. on the 7th day of February, 1939 and will be immediately publicly opened and read by the Electric Power Board of Chattanooga.

Copies of the Proposal, Contract Documents, and Specifications may be obtained from the office of the Electric Power Board of Chattanooga, Municipal Building, Chattanooga, Tennessee. A deposit (certified check) of twenty-five ($25.00) dollars will be required for procuring the Proposal, Contract Documents, and Specifications. The deposit for these documents will be returned to all except the successful bidder upon the return of the documents in good condition within ten (10) days after the bids are opened.

A copy of the Proposal, Contract Documents, and Specifications may be examined free of charge at the Chamber of Commerce and the office of the Electric Power Board of Chattanooga, Chattanooga, Tennessee.

Each bid must be accompanied by a Certified Check, or Bidder's Bond executed by the bidder and a surety company licensed to do business in Tennessee, in the sum of ten (10%) per cent of the amount of the bid. The bond is required as a guarantee that if the bid is accepted, a contract will be immediately entered into and the performance of it properly secured. The successful bidder will be required to execute a Performance Bond in the amount of one hundred (100%) per cent of the contract price. This Performance Bond shall be made through a company having a duly authorized representative in Chattanooga, Tennessee upon whom process may be served.

Proposals may be submitted on all items conditioned upon the award of all parts and/or any or all of the six parts of this contract. The Owner reserves the right to make the award on the separate parts of any combination of parts of the proposal in case separate awards would be to the Owner's advantage. All items in the proposal form (or any part selected) and on date sheets must be properly filled out and must not be detached from the specifications. No qualifying letters or statements will be considered.

Bidder's name must be placed on the envelope containing this document and also upon this envelope shall be designated the name and contract number which the bid covers.

WITHDRAWAL OF BIDS: Bidders may withdraw bids at any time prior to the opening, but thereafter no bidder may withdraw a bid submitted for a period of sixty days after the date set for the opening of such bids.

The estimated cost of the equipment of the Project covered by this Contract is $11,000.00.

The Electric Power Board of Chattanooga, Chattanooga, Tennessee, reserves the right to reject any and all bids, and to waive informalities therein.

Any bid received after the scheduled closing time for receipt of bids will be returned to the bidder unopened.

CITY OF CHATTANOOGA
ELECTRIC POWER BOARD OF CHATTANOOGA
Chattanooga, Tennessee
By: L. J. Wilhoite, Chairman
J. C. Twinam
Stanton E. Smith
Will F. Chamlee, Counsel
Attest:
N. J. Simmons, Secretary

Bids: February 14 (57)

Overhead Lines

Overhead Distribution Lines
and Street Lighting
P.W.A. Project Docket No. Tenn-1105-P-DS
Electric Distribution System
SUB-PROJECT—CONTRACT NO. 2-C
CITY OF CHATTANOOGA
ELECTRIC POWER BOARD OF CHATTANOOGA
Chattanooga, Tennessee

Sealed proposals for the construction of sub-project—Contract No. 2-C of the Electric Power Board of Chattanooga, acting for and on behalf of the City of Chattanooga,, Chattanooga, Tennessee,

P.W.A. Project Docket No. Tenn. 1105-P-DS
Electric Distribution System
SUB-PROJECT—CONTRACT NO. 2-C

will be received by the Electric Power Board of Chattanooga, Chattanooga, Tennessee, at the office of the Secretary of the Electric Power Board of Chattanooga, Municipal Building, Chattanooga, Tennessee, until 1:30 P.M. on Feb. 14, 1939, and will be immediately publicly opened and read by the Electric Power Board of Chattanooga.

Copies of the Proposal, Contract Documents, Plans and Specifications may be obtained from the office of the Electric Power Board of Chattanooga, Municipal Building, Chattanooga, Tennessee. A deposit (certified check) of One Hundred ($100.00) dollars will be required for procuring the Proposal, Contract Documents,

(Continued on opposite page)

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OFFICIAL PROPOSALS